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INSECTS, FUNGOUS DISEASES,—TREATMENTS

EVIDENCE

OF

DR. JAMES FLETCHER

ENTOMOLOGIST AND BOTANIST

BEFORE THE

SELECT STANDING COMMITTEE

ON

AGRICULTURE AND COLONIZATION

1902

PRINTED BY ORDER OF PARLIAMENT

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1902



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DR. JAMES FLETCHER

INSECTS, FUNGOUS DISEASES,—TREATMENTS

HOUSE OF COMM.
COMMITTEE ROOM 34.

OTTAWA, March 30, 1903.

The Select Standing Committee on Agriculture and Colonization met here this day at ten o'clock a.m., Mr. Ross (Ontario) presiding, pro tem.

Dr. James Fletcher, Entomologist and Botanist of the Experimental Farms, was present by request of the Committee, and made the following statement with reference to his work during the past year :—

VALUE OF THE COMMITTEE'S INVESTIGATIONS, TO AGRICULTURE.

Mr. Chairman and Gentlemen, as I have said before at this Committee, one of the pleasant events of the year is appearing before the Select Standing Committee on Agriculture. It is not only pleasant, but it is very useful to me in my work. The work in the Division under my charge which deals with entomology and botany, or insects and plants, is, of course, of much importance to the agriculture of the country. This is plainly shown by the large number of inquiries which come before us every year with regard to injuries that occur to crops, from insects and fungous diseases, as well as from the occurrence of weeds or other injurious plants. There is already a great deal of correspondence in the department, which I am thankful to say is gradually increasing every year, showing that the value of our work is becoming recognized. During the past year over 3,000 letters were received from farmers and others in the country asking for information about plants and insects. This, of course, brings us into contact with the people most interested in all parts of the Dominion.

I have stated on previous occasions that appearing before this Committee is of a great deal of use to me, and I feel more and more that that is the case, because the members who attend ask many questions and learn the scope of our work, then when difficulties arise among their constituents or in their own localities, such as injuries to crops either from fungous diseases or insect attacks, they put their friends in correspondence with the Division of Entomology, and in that way we are able to disseminate some of the information that we have gathered through a great many years of study of this particular kind of knowledge. This work is increasing from year to year, which is very satisfactory, from my point of view, at any rate.

THE INJURIOUS INSECTS OF 1901.

With your permission, I will refer briefly to some of the injuries to crops which have come before me during the past year, taking first of all those that were due to insects, and speaking of them in their order of importance, on account of the injury done. I will refer to them under the different heads.

THE SAN JOSE SCALE AND THE REMEDIES FOR IT.

The subject which is now always of very great interest, and particularly so in the fruit growing districts, is the San José Scale which was introduced into Canada,

only within the last five years, but which has already done a great deal of harm in our country. The useful knowledge with regard to the life habits of this insect and the best ways of fighting it are increasing from year to year, and the condition of affairs to-day is very much more satisfactory than it has ever been possible for one to say before. It is without doubt the most injurious fruit insect we have ever had to study practically. Notwithstanding that so much good work has been done, particularly in the province of Ontario, by the Provincial officers, there is still much to be learned by the fruit growers of the Dominion. At the present time this pest occurs in Canada, in Ontario only. The matter has received close attention from the Federal and Provincial Governments, and, as a result of much careful experimenting, I am to-day able to claim that there are already three remedies which will give paying returns if they are applied carefully and with the necessary trouble and expense. They are practical remedies, in that they will control the insect sufficiently to allow paying crops to be grown, but they are such as will still be thought rather expensive or difficult remedies which many farmers will hesitate to adopt on account of the expense necessary in applying them. However, I believe that judged as any other ordinary business transaction, the results of the work will pay very largely if the remedies are put in force as advised.

The whole of this work is detailed at some length in my forthcoming annual report, but I will just mention what these three remedies are, because information given before this Committee, as a rule, gets to the country long before the Departmental report is issued.

SPECIAL REMEDIES.

Of the three remedies I will mention first Crude Petroleum. This is probably the most effective remedy, but it is one which is rather more dangerous to use than will allow of its being recommended for general use by the ordinary fruit grower. It is very largely used now in Ontario and the United States, and we know that with proper care, orchards can be protected from the San José Scale without injury to the trees. It therefore pays all fruit growers whose trees are affected, to find out what is the proper way to apply crude petroleum to their trees, and to follow closely the specific instructions which are issued both by the Federal and Ontario Governments, if they wish to get the best results of their labours. In western and south-western Ontario the time has gone past when fruit growers can afford to neglect the precautions advised against insect enemies, and the application of proved remedies. In the part of Ontario where the San José Scale has been introduced, they must for many years be prepared to make a continued effort to stamp out this pest.

By Mr. Wright:

Q. Has the San José Scale appeared in eastern or central Ontario?

A. No.

Q. Only in the west?

A. I think we may outline the district where it has appeared in injurious numbers, as the district which is broadly known as the peach district. That is, the west of Lake Ontario and along the north of Lake Erie. Where you can raise a paying crop of peaches there you will find, I think, that the San José Scale will thrive, if introduced.

Regarding the injurious effect of this insect on the trees, too much cannot be said. It had been hoped that because Canada was so far north the scale would not be so likely to destroy the trees as elsewhere, but that is now known to be a very erroneous idea. I have been lately in orchards where I saw apple trees, the least susceptible to injury of all our fruit trees, which were actually dead from the attacks of the San José Scale. So that question is answered, once for all, that the San José Scale can destroy fruit trees in Canada. I have seen apple, plum, peach and pear trees, during the past season, all of which were dead, and they had been killed by the San José Scale.

By Mr. Wade:

Q. Does it attack shrubs?

A. Yes. All kinds of shrubs are liable to attack.

Q. Anything woody?

A. It will attack any tree or shrub, anything with woody stems. It still can be said, however, that in Canada it has not spread into the forests or on to wild bushes. This matter is being closely watched. The San José Scale is an imported insect, and the conduct of imported insects is peculiar. It is often several years before they leave the trees on which they originally appear. There are many cases in which this scale insect has appeared on fruit trees in orchards, but I know of no case where it has spread to any extent from the orchard to adjoining shrubs or trees. Perhaps after some years it may do so, but then, possibly, some of its enemies may also appear and bring down its numbers, as in other parts of North America.

By Mr. Wilson:

Q. Is it increasing in Canada?

A. The limits of the infested area are not increasing in Canada, but within that area there has been considerable increase.

Q. I mean within the limits that you speak of?

A. It did not spread very much last season beyond the limits reached in 1900, but it did spread to a considerable extent within those limits. It is still very hard to get fruit growers to understand the danger from infested trees. Last summer, I was in an orchard where the owner claims to have 20,000 trees. This was a well kept orchard of healthy trees. Two years ago a few trees were found to be infested by the Scale. Nothing was done to control it, and now it may be said that the whole of this magnificent orchard is infested and may be a total loss. Some rows of trees which were known to have been longest infested, were at the time of my visit in a dead or dying condition. I do not know whether the owner is going to attend to his orchard properly or not, but it will now be a great expense to do so.

The matter should be considered from two points: from the owners' point of view it may be asked, is he going to save his orchard from this pest which will certainly destroy it if he does nothing; and, besides this, it must be remembered that there are other fruit growers in the vicinity, who are in great danger of losing their orchards from his neglect.

By Mr. Wilson:

Q. Is there any law to compel a man to take steps to prevent the spread of this insect to his neighbours trees?

A. Yes. The Ontario law demands that the orchard shall be treated, and, until it was amended, this law insisted that infested trees should be destroyed. There was such an outcry from fruit growers that the law was changed, but the Government is trying all it can to discover the best remedies by which this insect can be controlled.

Q. Is there any recourse against a man's neighbour if the scale spreads through his neglect?

A. I am afraid there is not.

MR. SMITH (Wentworth).—A law recently passed by the legislature makes it a misdemeanour punishable by a heavy fine for a man to have the scale on his premises, and the municipal inspectors can take steps to make him have his orchard cleaned out.

Q. I knew that bill was going through and was much interested in it, but I did not see the final provisions of it. Is that how it reads?

A. Yes.

The WITNESS.—This law then makes it a misdemeanour to have the scale in one's orchard without taking steps to stamp it out. That was the discussion, whether there was to be a penalty or not. Of course the law would be no use unless there was a penalty. That answers Mr. Wilson's question.

By Mr. Wilson:

Q. A law is no good without a penalty?

A. Not much, I am afraid.

Mr. SMITH (Wentworth).—There is a penalty.

The WITNESS.—You know the importance of this question, Mr. Smith. I would ask the Committee's pardon for stopping a moment to ask you if you think that fruit growers in Canada are yet understanding the enormous danger from this insect, and are taking reasonable and common sense measures to prevent it spreading?

Mr. SMITH (Ontario).—I may say, Mr. Chairman, that they have not up to the present time; but they are beginning to realize it. Those men who went to Toronto two years ago with clubs in their hands and demanded of the Government that the law which would have stamped it out if it had been enforced ever since, should be repealed, are now sorry for having had it repealed, and they would agree to any sort of legislation to-day that would eradicate this pest.

The WITNESS.—I am very much obliged to Mr. Smith, because he is a practical man, a practical nursery man with a large amount of money at stake, and he understands this question as a question of business. In going through the country, I have seen for five years that there was an enormous danger hanging over the country; but it seemed impossible to get the very men who were going to lose their money, to understand it. These very men that Mr. Smith refers to, brought out their guns, and were going to shoot the Government inspectors if they went into their orchards to destroy the trees that were affected. Had these trees been destroyed, I believe it would have been a very great blessing to them.

CRUDE PETROLEUM,—FIRST REMEDY.

I went all through the orchards in that district last autumn with Mr. George E. Fisher and was much pleased to find that the fruit growers are beginning to see the danger from this terrible insect; they are buying large quantities of crude petroleum, and intend this spring to experiment with it largely. Some of their most enterprising men began last season, and I am somewhat afraid lest, after they secured such good results last year from using a 15 per cent mixture of crude petroleum and water, this may engender some recklessness next season. The oil was sprayed over the trees, and they obtained very good results; now, having got these good results and done no harm at all with a mixture containing 15 per cent of crude oil, I am afraid there will be injury next year, because while 15 per cent is harmless, and you may use probably 20 per cent without danger, there will be a tendency to increase the strength of the mixture, because of these good results, and a 25 per cent solution may do harm, even to apple trees, and certainly will do so to peach and plum trees. These men are liable to increase the amount beyond the safety point, and the difficulty will be that the whole thing will get a set back. We have been trying to persuade these men to do something, and I am afraid they may now do a little too much. The one point with regard to the San José Scale, which I wish now to bring before the Committee, is that there are three practical remedies against the San José Scale. Crude petroleum is one of these and may be used by the ordinary man if he will remember he must not exceed a 20 per cent application; that is, one-fifth of a mechanical mixture of crude petroleum

and water may be safely applied to the trees. Another rule of thumb, but a very good one which has been put forward by Mr. G. E. Fisher, the inspector for San José Scale for the Ontario Government, is that not more than one quart of crude petroleum may be sprayed on to an average sized or full grown peach tree. If that quantity is exceeded there is danger. Crude oil costs 2 or 3 cents a gallon as supplied by the Ontario Government.

WHALE OIL SOAP,—SECOND REMEDY.

The next remedy is Whale-oil Soap. This is a trade name for a potash and fish oil soap, which contains 10 to 12 per cent of potash. It is an exceedingly valuable insecticide which can be used with little danger, and is also valuable as a fertilizer on account of containing so much potash. The quantity advised, about one and a-half gallons per tree of a mixture of 2½ lbs. in an imperial gallon of water, equals the amount recommended as a light application of potash, when used in an orchard as a fertilizer.

REMEDY FOR LEAF CURL.

This soap is also a very effective remedy for some fungous diseases of fruit trees. One of the worst diseases of the peach is known as the Leaf Curl. The leaves of peach trees affected with this disease swell up and become distorted in June and July, and just at the time when they are required to perfect the fruit, they fall off. The fruit in consequence is smaller and not so valuable. This disease is almost entirely controlled by using whale-oil Soap.

Whale-oil Soap is recommended strongly for the San José Scale, and, although costing more than crude petroleum, it cannot be considered an expensive remedy. It costs 3 to 4 cents per pound, according to the quantity bought. It can be bought from Good & Co., of Philadelphia, and W. H. Owen, of Catawba Island. Both firms make a specialty of preparing this soap as an insecticide with the proper amount of potash, so that it may be sprayed of the required strength in a liquid form. I mention these two names because they are reputable firms that make a specialty of preparing this soap.

By Mr. Wilson:

Q. Could you not mention some Canadian firms who supply it?

A. That would not be advisable, because there are several of them, and the feelings of some would be hurt if they were not mentioned.

Q. I object to using the names of people from outside. There could be no objection to your mentioning the names of Canadian firms if you gave a list of people in our own country who make these soaps?

A. I will provide a list, if the Committee wishes it.

Q. That is all right.

A. I only mentioned the other firms because they were not in our own country. Can give you the names of some half dozen of Canadian makers, as follows:—

Canadian Manufacturers of Whale-oil soap:—

J. J. Ward, Conseccon, Ontario.

Imperial Varnish & Colour Company, Toronto, Ontario.

Empire Soap Works, Hamilton, Ontario.

D. Morton & Sons, Hamilton, Ontario.

J. H. McMeekan, London, Ontario.

By Mr. Cochrane:

Q. Do I understand you correctly to say that one-third of crude petroleum was sufficient?

A. One-fifth. One-third would be too much.

Q. Well, if a one-fifth mixture of petroleum is the proper quantity, and they put a larger quantity of petroleum and use a smaller quantity on the tree, it would have the same effect as if they used a larger quantity of the weaker solution?

A. The whole tree must be covered; for this reason the water is added. I should have said that the spray should only be applied until it begins to drip from the tree. I am very much obliged to you for mentioning the matter. The matter of spraying is one which is now very well understood by most of our fruit growers all over the country. The rule is to only apply the spray until it begins to drip from the leaves. By this method, too much mixture is not applied, and there is no waste of material.

Q. How far east has this San José Scale extended?

A. About to Burlington.

Without digressing too much, I may say that the materials used for spraying are really not more important than the implement used, the spraying pump and the nozzles. These must be of the very best kind. Fruit growers are now recognizing that, and there is a keen competition between the spraying pump manufacturers. The growers are buying the very best materials and implements for use in their work. I can only say this, that a poor pump is one of the most fruitful sources of failure in the spraying of trees. I think we need not discuss the question now, whether it pays to spray trees with arsenical poisons for leaf-eating insects, and the Codling Moth. That fact has been widely recognized, and the well known remedies which are published in our spraying calendars and sent out in large numbers every year from the Experimental Farm, and reprinted in many of the seedsmen's catalogues, have made these remedies so well known that I need not dwell upon them now. I think it is wise, however, to take up the time of the Committee with the result of those remedies I have spoken of, and which should be brought before the country at once, because there is little doubt of the good which has resulted from the large amount of expense and labour which has been given to these experiments. My opinion is that the San José Scale question presents a much more hopeful aspect than it ever has before. These remedies, although rather expensive, will give paying returns, and the trees may be held in a condition to bear paying crops, if the remedies are applied every year. They must be applied every year, because the rapid increase of this insect is such that unless the spraying is kept up regularly the trees will be destroyed in a very short time.

FUMIGATION;—THIRD REMEDY SAN JOSE SCALE.

By Mr. Richardson:

Q. What is the other remedy; you have given us only two, the crude petroleum and whale-oil soap?

A. It is Fumigation. The method has been adopted by nurserymen in fumigating all their stock before they send it out, and it has also been adopted by the Federal Government in the fumigation of imported stock that comes in from any other country where the insect has occurred. The material used is hydrocyanic acid gas. Sulphuric acid is mixed with water, and into that is placed cyanide of potassium. This gives off one of the most poisonous gases known, and any insects subjected to the fumes of this gas for a short time—in the case of the San José Scale, 45 minutes—are entirely destroyed.

Very careful experiments have been made with this gas to find out whether it is always reliable, and I may say that I have never known of an instance where a tree

which was passed through the fumigating house and been kept there for the prescribed 45 minutes, showed a single living scale insect. This plan is also applicable for small trees and fruit bushes out of doors, but on account of the size and cost of the tents required for larger trees, as well as their perishable nature and the difficulty of handling them on windy days, the expense of this remedy has prevented it from coming into very extensive use. Where fumigating can be practised, it is perhaps the surest remedy of all.

The hydrocyanic acid gas is very deadly to all animal life, and if applicable to large trees would undoubtedly be the best treatment of all for the San José Scale.

By an hon. member:

Q. Does it require the use of a tent?

A. It requires the use of a tent, and these tents are very perishable. The handling and raising and folding of them, seems to destroy them much sooner than might be expected from the use of ordinary tents. The splashing of the sulphuric acid, which sometimes takes place when the cyanide is dropped into it, makes it boil up for a moment, and if it fall on the canvas, it destroys the tent. On small trees and bushes such a makeshift as an ordinary tight barrel gives excellent results. This is convenient for use on rose bushes, gooseberry and currant bushes. Excellent work has been done by Mr. Fisher, in Ontario, with ordinary tight apple barrels with the cracks closed with clay, &c. Petroleum barrels are too heavy to handle. The apple barrels gave excellent results. On bushes treated early in the spring, there was no sign of the insect in the autumn.

These are the three remedies which I consider are practical if applied carefully, whale-oil soap, in the proportion of two and a-half pounds to one imperial gallon of water, and, when this soap is made with potash, it remains liquid and can be used through an ordinary spraying nozzle. Crude petroleum applied as a mechanical mixture with water, one-fifth of the whole mixture being oil, and fumigation with hydrocyanic acid gas for 45 minutes—for every 100 cubic feet one ounce of cyanide of potassium, one ounce of sulphuric acid and three ounces of water. The cubic contents of the inclosure must be calculated and the gas generated to the required amount.

THE LOCUST PEST,—REMEDY FOR IT DISCOVERED.

The outbreak of injurious insects which probably was of most importance from the injury done last year, was of locusts or grasshoppers in Manitoba. This occurred over exactly the same area as during the year before. Owing to the phenomenal wheat crop of 1901, in the west, little was known of the injury except in the localities where the loss was felt.

The announcement I wish to make now, is of a very excellent practical remedy which was discovered by a wideawake young farmer of Manitoba, named Mr. Norman Criddle, of Aweme. This gentleman, who is a student of natural history, had noticed in driving along the roads, that grasshoppers always collected thickly wherever there were any horse droppings on the road. The old remedy, which had given good results in checking the ravages of grasshoppers in California, viz., a mixture of bran and Paris green had been used to some extent. This remedy, however, seemed to those who had not tried it, such an unpractical remedy that it was difficult to get farmers to adopt it, especially when they had to pay \$18 to \$20 a ton for bran. Although very effective, it certainly was, with bran at such a price, an exceedingly costly remedy. When Mr. Criddle noticed that the grasshoppers devoured the horse droppings so greedily, it occurred to him to substitute that material for the much more costly bran. Having collected a supply of this material, he poisoned it with Paris green, and distributed this around the edges of his wheat fields and secured most satisfactory results. He took an ordinary coal oil barrel, cut it in half, and put the two tubs thus made, on a waggon, having filled them with the poisoned mixture. He then drove around the

edge of his crop. One man drove, while the other took an ordinary trowel and threw the poison for about twenty to thirty feet out into the crop from the edge. The result of this was very soon seen. The grasshoppers were attracted to the mixture from a long distance and myriads of them were poisoned. A neighbour of Mr. Criddle's had 200 acres of wheat. One hundred acres was destroyed entirely before the remedy was applied; but with this simple means he saved the other 100 acres, to the extent of getting 1,700 bushels of wheat. On one hundred acres he got nothing at all, and on the other 1,700 bushels of good wheat, as the direct result of this work.

I had an opportunity of going through the whole of this district to examine it, for the Manitoba Government, last season, and found that wherever this remedy was applied there were good crops, while in many other places there had been great destruction. The announcement of this remedy I consider very important, because wherever grasshoppers occur in destructive numbers, it can be used. Such easily obtained materials as horse droppings and Paris green make it a very convenient remedy, and as it is very efficacious, much saving will result in similar outbreaks, if we can only persuade people that it is a good and practical remedy. It is so cheap that many will try it. If it is used early enough in the season, when the chief injury is done, a large proportion of the crop will be saved, even in bad grasshopper years. Very frequently serious injuries are suffered because preventive measures are not taken in time. Mr. Criddle's neighbour, referred to, Mr. Vane, is quite sure he could have saved his whole crop if he had applied the poison early enough. A farmer near Sewell Station, on the Canadian Pacific Railway, lost 200 acres of wheat, which was eaten bare to the ground. A neighbour of this gentleman, just a couple of miles off, applied the Paris green and bran at first and afterwards the poisoned horse droppings, and reaped a good crop. I visited his farm in the first week in July and counted dead grasshoppers lying all through the crop. There had been a high wind for two days previous to my visit, and the grasshoppers had gathered under a little headland for shelter. On a little patch 18 inches square, I counted 117 dead grasshoppers. Walking through the crop, you could not put your foot down without touching some of them lying dead or dying from eating the poison.

That shows the enormous number in which the insects occur, and the efficacy of this simple remedy, which can be applied by any farmer without any special implements and without very much labour.

At any rate, at that time of the year there is not very much to be done on a Manitoba wheat farm.

By Mr. Wilson :

Q. At what time of the year would you do that ?

A. I was there about July 1. The grasshoppers were then just getting their wings. The poison should have been put out sooner.

By Mr. Wright :

Q. In Manitoba ?

A. Yes, in Manitoba.

By Mr. Wilson :

Q. I understood you to say a little earlier would have been better ?

A. I meant about a week or ten days sooner than it was applied, some time before the grasshoppers get wings. The grasshoppers got fully developed wings about July 1, last year.

By Mr. Gould :

Q. Before the wheat has headed out ?

A. Yes. I was in Manitoba about the time the wheat was heading out. When the young grasshoppers hatch from the egg, they are very small, less than a quarter

of an inch, and then for about three weeks they keep feeding and growing larger, and change their skins five times. It is only after the last moult that they have wings. Any time before they get their wings, the remedy is much more efficacious, because then they can only hop and creep; afterwards they can do great injury to the growing crop, because they can fly easily from place to place.

Q. From June 20 to July 1 is the best time then?

A. Yes. From June 20 to July 1, or a little earlier if the season is the same as last year.

By Mr. Robinson (Elgin):

Q. Can we depend on the Paris green for destroying them?

A. I think on the whole it is the best poison to use.

Q. Has it come to your notice that the Paris green made now is not of pure quality?

A. That is not quite so much the case, I believe, as is supposed. Three or four years ago the Government took a great deal of pains to have this matter investigated, and, as a matter of fact, to-day there is a law preventing the sale of anything under the name of Paris green which is adulterated. Anything sold as Paris green must have a certain percentage of arsenious acid in it, for Paris green is the name of a material with an exact chemical formula, and, if anyone sells anything under the name of Paris green, which has not that formula, he is punishable by law.

Q. Are there inspectors under the law?

A. Yes, and Mr. Macfarlane, of the Inland Revenue Department, analyses a great many samples in his department.

Q. I heard it stated at a farmers gathering that a man had mixed Paris green with other material and thrown it in a crop and the hogs got in and ate it and fattened on it.

A. Yes, I have often heard similar statements, but they are not always exact. I am very glad the matter has come up, for the reason that there seems to be a general impression all over the country that Paris green is very much more adulterated than I believe is actually the case. If it is adulterated, it is not Paris green, because the Act specifically states that Paris green must contain a certain chemical formula, and, if it does not, under the law, it is not Paris green, and must not be sold as such.

By Mr. Wilson:

Q. What is the percentage of arsenic?

A. I do not remember exactly, but it is about 56 per cent, I believe.

By Mr. Ross (Ontario):

Q. There is no danger of this mixture poisoning any of the animals around the farm, chickens, &c., is there?

A. No, I think not.

Q. It is dangerous throwing poison around the place, you know.

A. I do not think there is any danger when applied as I have said.

By Mr. Robinson (Elgin):

Q. The horse droppings would prevent anything from eating it?

A. Yes; there was perhaps some danger with the bran, but the only things we know of having been killed were field mice. I have not heard of any instance even of chickens being killed by eating it.

Q. But there would be that danger, I think, if some other material than horse manure were used.

A. Possibly, some precautions might have to be taken, such as keeping them shut up for a time.

By Mr. Wilson:

Q. Horse manure is the cheapest mixture ?

A. No doubt, and much more attractive to the grasshoppers.

HOW TO SAVE BINDER TWINE FROM BEING EATEN OFF THE SHEAF.

Another interesting result which came up in these experiments with grasshoppers, was the effect of adding salt to the mixture. A difficulty which is sometimes experienced by farmers in Manitoba, is that field crickets and grasshoppers eat the binder twine with which the grain is bound in the field, and this is a constant source of trouble, and sometimes a good deal of loss and extra labour results from this. Mr. Vane and Mr. Criddle tried several things, among others salt. They soaked their twine in brine to see if that would prevent the insects from eating it. Instead of having the desired effect, they found that it was eaten much more readily. They therefore added salt to the horse manure mixture, and found that it was much more attractive as a consequence. They therefore now always add a pound or two of salt for every pound of Paris green. Further, they found that the binder twine could be protected by soaking it in a solution of bluestone, two pounds to seven gallons of water.

By Mr. Gould:

Q. I do not see how he could soak it, the balls are rolled solid.

A. He soaked them in warm water, leaving them for half an hour.

Q. But the balls are so hard I should think they would not get saturated at all ?

A. They did, and he then dried them by putting them up on the rails of a fence to dry in the sun.

POISONING SPARROWS AND GOPHERS.

By Mr. Johnston (Cardwell):

Q. Just before leaving that question of poisoning insects, can you give any suggestion as to how to poison sparrows, which are becoming a great pest on the farms and around barns ?

A. I think strychnine is the poison generally used for that purpose.

Q. How do you apply it ?

A. It is dissolved in alcohol, and then after dilution with water, grain is soaked in it.

Q. Is there not a danger that the chickens might get it ?

A. Yea. There is danger of that, but it must be put out of their reach.

By Mr. Stewart:

Q. Large quantities of strychnine are used in Manitoba to poison the gophers. You need to use it in very small quantities ; one two-hundredth part of a grain will kill a gopher. One grain of strychnine weighed in the druggist's scales, was dissolved in water, and two hundred grains of wheat were counted out, and soaked in the water. A single grain of wheat was enough to kill a gopher.

A. That may account for the failure of some of the experiments which have been tried with sparrows. You see it frequently stated that at first a few sparrows are poisoned, but the others soon learn, and will not after that touch the grain. It has been found very frequently that sparrows after a short time cannot be poisoned. It may be that the poison was applied too strong, and they detected its presence and would not eat the grain.

By Mr. Johnston (Cardwell):

Q. The difficulty we find is that the sparrows took the bran off the grain, the sparrows would simply shell the grain and take the inside.

A. I think they would eat the wheat grains whole.

Q. There are some grains they will not eat. They will not eat buckwheat whole, and they will not eat oats whole. If you give them good wheat and oats they won't touch the wheat, until they have eaten the oats, which they will shell first?

A. I have noticed that, but they are very wise birds.

THE HESSIAN FLY.

The Hessian Fly did a great deal of harm in western Ontario last year, but the indications are that there will be less injury by it next year. Fall wheat sowing last autumn was for the most part done later than usual. This was strongly advised by those who had studied the habits of the insect, and the beneficial results were very marked last autumn. Fall wheat sown late, in western Ontario, went into winter with an excellent appearance, and I have every hope that there will be a better crop next season than there was last. There will be some injury, of course, because the Hessian Fly was very abundant and the maggots were present in fields sown early; but in many instances the injury will probably be less than in 1901. After a little while we shall get back again to normal conditions, and this will be sooner than otherwise, if farmers will only sow their wheat later, as a general rule.

By Mr. Ross (Ontario):

Q. Does it attack the fall as well as the spring wheat?

A. It does, and very much more than is usually noticed. The maggots live in the shoots of spring wheat close to the ground, and you will find that instead of there being 4 or 5 stools to a plant there is frequently only one which sends up a stem. This injury is exactly the same as is seen in autumn in fall wheat. The injury to spring wheat which is most often seen, is at the second joint of the stem. The injury to the young shoots is often overlooked.

By Mr. Robinson (Elgin):

Q. It attacks barley as well?

A. Yes.

By Mr. Ross (Ontario):

Q. Does it attack winter wheat in the fall?

A. Yes. The egg is laid in September, and the maggot destroys the young shoots and passes the winter in them.

By Mr. Stewart:

Q. Is it in the flax-seed state?

A. Yes, it passes the winter in the flax-seed state, which is simply a grub encased in a winter covering which is dark brown, and very much resembles a flax-seed.

Mr. STEWART.—I remember getting one in the winter of 1899, and I did not know what it was. We had it in parts of Manitoba in 1899.

The WITNESS.—Q. Was that in spring wheat?

A. Yes.

The WITNESS.—In Ontario it appears twice in the year, that is, there are two broods.

Mr. STEWART.—It had broken down the wheat close to the ground ; the grain was good enough, but the stem was broken down.

The WITNESS.—Well, it may perhaps have been pretty good, but as a matter of fact it was, I imagine, a good deal reduced in weight. The sudden appearance of the Hessian Fly in Manitoba two years ago was very remarkable, because it had never occurred there before. As is well known, only spring wheat is grown in Manitoba ; this fact limits very much the possibility of this insect becoming firmly established there and increasing. Further to the south, as in Ontario, where fall wheat is grown, there are two broods or occurrences of the Hessian Fly in the year, one in the spring and the other in the autumn. Where there are fresh fall wheat plants for the females to lay their eggs upon, the young maggots have food ; but, as there is no fall wheat grown in Manitoba, the female flies die without doing any harm. We do not know any native or cultivated grass that this insect can feed upon, although these have been looked for most carefully in districts where it is common. Wheat, barley, and rarely rye, are the only plants in this country upon which the maggots are known to feed.

An interesting provision of nature often seen with an insect which has normally two broods in a year, is that there are always a certain number of the first brood that go over the winter without emerging, so that, although the insect may nominally have two broods, there is only one brood of some of the individuals ; that is, some of those that should appear late in the year, do not do so until the next spring. This, of course, has the effect of carrying the insect over some difficulties, and the remarkable feature of the Hessian Fly's first appearance in Manitoba was that it appeared all at once, in enormous numbers, over the whole country. I noted its injurious occurrence in Minnesota in my annual report of the year before. The conditions in Minnesota are very similar to those which prevail in Manitoba, and I anticipated that we might see something of it. It probably did occur to some extent in 1899, but was not so bad as in Minnesota, and was overlooked. Everybody noticed it in 1900, on account of the extent of its injuries. Fortunately it disappeared as suddenly as it came, and there was no report of loss from the Hessian Fly last year, in Manitoba.

By Mr. Robinson (Elgin):

Q. You thought it would go away ?

A. Well, I hoped that that might be the case, because it had never done harm there before. From what I have been able to learn, I do not think that we shall be bothered with it this year to the same extent in Ontario as we were last.

Q. Some farmers did not even get seed, or even sow last fall.

A. That is always one of the chief troubles when there is a special outbreak of any pest ; there is such a small margin of profit for the farmers in their work that under such circumstances they cultivate a much smaller area of a crop which has been injured, or will not sow at all the next season. That is particularly the case with the next insect I want to speak of, which is doing great harm in Canada to-day.

THE PEA WEEVIL.

By the Chairman:

Q. That is the pea bug ?

A. Yes, that is the common name for it. More farmers are now saying that they will not sow peas again on account of the Pea Weevil, than has ever happened before in my experience. The remedy is so simple that there is in my opinion no need for this step, and there is no excuse for farmers not taking better precautions against loss from this pest.

REMEDY.—There is the well known remedy of fumigating the seed with bi-sulphide of carbon, by which the seed peas can be treated in an easy way, which any farmer can use, and which is perfectly satisfactory and effective, and yet many farmers are talking of going out of the cultivation of this most important crop.

By Mr. Wilson:

Q. You might give us the method of applying that remedy ?

A. I will. The pea crop is far too valuable for farmers to give it up without a great effort being made to save it. All the large seed merchants should, and may have, 'bugging houses,' as they are called, where the seed peas are treated, and all the insects inside them are destroyed ; but I feel sure that they are not using them as much as they used to do. On making inquiries, I am told that the best firms treat their seed as carefully as they did a few years ago, but I cannot think that this is the case, for pea seeds are constantly being sent in to me by farmers with requests for advice as to the way to kill the insects before sowing. Farmers should refuse to buy from firms who will not treat their seed, or in other words, who put the farmer to the expense of doing this work for them, and yet charge the full price for the seed. Weevilled seed peas are the chief means by which the insect is introduced into fresh districts, and this was undoubtedly the way in which the Pea Weevil was imported into Canada. The remedy as advised is quite reliable, and I urge its more general adoption on seedsmen and growers alike, as the best means to prevent the great loss which takes place every year from this cause. The work should be done as soon as possible after the peas are harvested. Thresh early and treat the seed at once. As a rule the weevils pass the winter as fully developed beetles inside the seed ; although in some seasons many may leave the pease in the autumn. Early treatment of the seed not only destroys more of the insects, but does so before they have eaten so much of the seed, as is the case if the fumigation is not done until spring. For seedsmen who have large quantities of seed to treat, 'bugging houses' are necessary. These should be specially built for the purpose, away from all buildings and outside of towns.

HOW TO APPLY THE REMEDY, AT HOME.

For farmers, many of whom use their own home grown seed, there is an easy method, which I have described in several of my reports. This consists of placing any quantity of seed up to 5 bushels, in an ordinary coal oil barrel, which will hold about that quantity nicely, and then pour on top of the seed, or place it in an open saucer, 1 ounce of the bi-sulphide for every 100 pounds of seed ; close the barrel tightly and leave it closed for two days. Bi-sulphide of carbon is a colourless liquid with a very unpleasant odour, which vaporises readily in the ordinary temperature of the atmosphere in autumn. The vapour is heavier than the air, and consequently it sinks down through the peas in the barrel, and as it is very deadly to all insect life, it will in the time mentioned, 48 hours, penetrate through the skin of the pease and destroy all the weevils in the seed.

Q. You have to do it immediately after harvest to prepare the seed properly for the next year ?

A. That is the best time.

By the Chairman:

Q. If the seed peas are buggy, they would spread the pest ?

A. Certainly ; but this insect is limited in the area where it propagates. Two or three years ago there was a large quantity of high class peas sent to the Almonte district to be grown for seed, because that district is outside the area where the Pea Weevil occurs naturally. Peas are a crop which can be grown in many districts where

the bug does not occur. Where it does occur, it can to a very large extent be destroyed in the seed, and the crop grown from these seeds must be to that extent cleaner than where no precautions are taken.

By Mr. Smith (Wentworth):

Q. Can that be done in a bin?

A. Undoubtedly, if they are tight bins. In some of the big houses they treat hundreds of bushels at a time in their 'bugging houses.'

Q. Suppose municipalities or a number of municipalities or a province would adopt a law compelling everybody to destroy the weevil in their crop; would not that eradicate this pest, which is a very serious evil?

A. United action is the thing most needed now. The Pea Weevil certainly can be destroyed in the seed, but it has got so firmly established that it will only be eradicated by stirring up every farmer who grows peas, to help to the extent of never sowing seed containing living weevils, to treat his own seed and insist on those who sell him seed doing the same, or refuse to buy from them, for there are several firms who do treat their seed properly before selling.

Q. If one crop is clean, will the weevil come from another farm?

A. Yes, it will, to some extent.

By Mr. Robinson (Elgin):

Q. What is that remedy called?

A. Bi-sulphide of carbon.

Q. Is it not dangerous for fire?

A. Yes, it is. It is wise to exaggerate to some extent the dangers of any of these remedies, so as to prevent loss; but I have found that this can be used with moderate caution. I would not fumigate pease in a house, but out of doors or under a covered shed away from buildings there is no fear of fire. The vapour is very inflammable, so no light must be brought near it when the work is being done.

By Mr. Smith (Wentworth):

Q. If a farmer did all you advise, still there would be very little chance of his crop remaining clean, unless all his neighbours took the same precaution?

A. Not at first perhaps in an infested district; but it would tell in time.

Q. It is very little use for one farmer to do it, unless his neighbours also do it?

A. That is true. United action is most necessary, and that is the chief reason I bring it before this Committee and keep on speaking and writing about it every year, because there is an enormous amount of loss, and I am very sorry to see farmers proposing to give up the growing of such a valuable crop as peas when by everybody taking action it would be possible in time even to stamp the pest out. Prof. Lohead, the Ontario Government entomologist, is now discussing with me the best plan of bringing the matter before the country more prominently, so as, if possible, to get action taken in the matter by farmers. There is a good remedy, and the cultivated pea is the only known food of the insect.

By the Chairman:

Q. The conditions you mentioned about peas exist in our neighbourhood. In the township of Roach, and more particularly to the south, the farmers have given up growing peas altogether, and it is very unfortunate. They have been trying to treat seed with coal oil. They don't seem to have understood this other remedy, but that has had a very good effect. Of course, I suppose you would apply this gas that you speak of upon peas for seed, not upon peas for animals, would you?

A. Yes. It would not injure the peas as food, in the least.

Q. Would it not poison the peas ?

A. Not at all, the bi-sulphide vaporizes entirely and very quickly. The vapour must be confined for two days even to kill the weevils. Directly you open the barrel, the fumes go off and the seed shows no trace of it.

Q. Do you not think the matter of sufficient importance for the government to issue a special bulletin with the information which you have about it ? It is most valuable information, and you could get it directly to the farmer by mailing it direct.

A. I believe it would be very useful.

Q. If a bulletin was prepared containing all this information bearing directly on the pea bug and sent to every farmer, it would, I believe, have a beneficial effect ?

A. I believe Mr. Dryden has some idea of doing something. Prof. Lochead wrote and asked if I would co-operate with him in a campaign against this insect. This I gladly consented to do.

By Mr. Gould:

Q. I think the great difficulty in treating seed peas is that they have treated them in the spring and not after the previous harvest, and then the difficulty was very much greater ?

A. The chief reason that the weevils have not been killed more systematically in the autumn is because farmers do not thresh their peas immediately after harvesting the crop. They usually postpone threshing until some convenient time during the winter. Of course, it would be far better if they would thresh at once after harvesting.

Q. It would be a good thing if the farmers would thresh at all events enough for seed and save it. As things are now, we are losing one of our best crops ?

A. Yea.

Mr. SMITH (Wentworth).—It was exactly the same with Black Knot and Yellows on our fruit trees ; we secured legislation to permit a township to pass by-laws for the entire eradication in one township of Black Knot, and in one year we entirely cleaned it out. Yellows, the same way, and we will clean out the codling moth in the same way. It seems to me that this insect is a much easier and more simple thing to get rid of than either of those I have mentioned. The only effective way in which it can be done, will be by legislation enabling municipalities to pass a law to compel everyone to fumigate peas. That would be easy. Your circulating bulletins would be educational, but only perhaps one farmer in twenty will fumigate his peas, and the weevil will spread from his neighbour's property and he will be discouraged ?

A. That is very true, but I know, and you know, Mr. Smith, it is rather difficult to get any legislation about insects, through the Ontario House just now.

By Mr. Wilson:

Q. It will not be next session ?

A. Remember the matter is not properly understood by all. You see, public opinion has not been educated enough yet, and that is why the Chairman's suggestion is a good one.

By the Chairman:

Q. How would it do if the government would have stations for the fumigation and an officer in charge ?

A. I think the crop is of sufficient importance to warrant that.

Mr. SMITH (Wentworth).—It is so easy to do it, the farmer can fumigate the peas right in his bin and leave them there. It is a matter of such little difficulty and cost that it would be no hardship to them to be compelled to do it.

Mr. GOULD.—The great difficulty is to get the farmers to do it immediately after harvest ; then everything is in a bustle ; people are busy and it is difficult to get them to do it.

Mr. SMITH (Wentworth).—In regard to these diseases of fruit, I have mentioned there is a time set in which to do it.

By Mr. Johnston (Cardwell):

Q. As I understand, it does not matter what time it is done, if you kill the insects. Would it not be an easy thing to have each farmer compelled to sow seed that is fumigated. There is no need to fumigate the whole crop ?

A. It would, and to do the work early this would save the destruction of much of each pea infested by a weevil. As soon as the fumigation is done, the seeds are saved from further injury. The weevil is eating the seed all the time until it attains full growth, and, if destroyed immediately after threshing, there is less of the pea consumed. Of course, the longer the weevil remains in the pea, the less valuable it becomes for all purposes. The grub will continue eating until it is full grown.

By Mr. Robinson (Elgin):

Q. How will it do to compel them to fumigate all they use for seed and to grind the balance ?

A. It would be a very good plan, but difficult to enforce.

By Mr. Smith (Wentworth):

Q. The way the Ontario Government does, is to leave it to the municipality to take the matter up ?

A. Any such step would be useful, but the same difficulty would exist as with individual farmers. On the borders of a protected municipality the weevil would come in from other municipalities outside for a year or two.

Q. But as soon as it was administered in one municipality and the effect was seen, would not the other municipalities take it up ?

A. Yes, I believe they would ; but the great difficulty is to get people to understand that fumigation is effective ; and, if everyone would sow uninfested or treated seed, the pea weevil could in time be entirely eradicated.

BLACK KNOT OF THE PLUM,—HOW TO ERADICATE IT.

By Mr. Ross (Victoria):

Q. I would like the Professor to give us some information about the Black Knot at our next meeting. I do not mean at this meeting, because the time is pretty well up.

A. Well, there is very little to say about Black Knot, except that the nature of the disease is thoroughly understood. It is due to a fungus which attacks the plum and cherry, and causes the conspicuous gall-like growths known as Black Knots. The remedy is to cut out each knot directly it is noticed.

Q. I have a paper here which was sent to me. Perhaps you might read it to the Committee and see if it has any valuable information.

A. Yes, this is Mr. Percy Blanchard's paper. I have seen it. The Black Knot is very injurious in Nova Scotia, more so even than perhaps in Ontario. The remedy, which is most to be relied on, is the cutting out of the knot by every person the moment he sees it on the trees. The remedy which proved of most use in Ontario was the one here recommended, namely, to use the knife, cutting out and destroying the knots the moment they appear. The paper is signed by Mr. Blanchard, of Baddeck, and was

posted up in all the post offices in Nova Scotia, where it attracted public attention, and was examined by many who might not otherwise have seen it. I saw it in some post offices in Nova Scotia last winter, and I brought it before the Fruit Growers Association of Nova Scotia at their annual meeting, as an example of what one man can do to benefit a whole district. Mr. Planchard gives concisely on this card the nature of the disease and the remedies.

By Mr. McGowan:

Q. What are the remedies he proposes?

A. It would not take many minutes to read the whole thing.

"MUNICIPALITY OF VICTORIA, NOVA SCOTIA."

To the Fruit Growers of Victoria.

I am requested by the Warden to send you for your consideration the following facts gathered from the most authoritative sources, in reference to Black Knot.

It was believed by early writers on this subject that Black Knot was caused by insects, but this erroneous belief has been clearly disproved.

Prof. Halstead says:—'There is no question whatever about Black Knot being caused by a low form of vegetable growth classed with fungi, which sends its minute threads through the substance of the twigs and branches.'

The beginnings of a young knot are manifested by the swelling and then cracking of the bark; and, in the cracks thus formed, the threads of the fungus come to the surface and clothe it with a covering of olive filaments bearing multitudes of spores. These spores when ripe are carried in the early summer in all directions by the wind, and, falling upon the surface of plum branches, germinate, and send their filaments or roots through the bark into the growing ring of soft wood beneath and form another knot.

As the season advances the knots turn black, throw out another set of seed spores which carried by the wind, start in the fall another crop to grow throughout the winter. Of Black Knot wherever on the bark they alight. These seed spores, so small as to be invisible to the eye travel on the wind and may do injury to a plum orchard miles distant.

Thus it is seen:—

That the seed spores are sown twice and possibly four times a year;

That the knot grows during the winter as well as summer;

That the disease has a foot hold on the bark before the spores are visible;

That one infested tree will scatter contagion throughout the settlement.

That one careless plum grower may do irreparable mischief to the whole community;

That only by ignorance of these proven facts will a good man injure his neighbour.

Remedies.—Remove every knot whosoever tree it is on, as soon as it makes its appearance. Rather than leave it, break off the knot by seizing and twisting it with the thumb and forefinger of one hand, holding the bough in the other hand.

To make a clean job cut the limb off four inches below the knot. Where the large-ment of the limb would render this wasteful, thoroughly pare off the diseased part, and smear the wound with paint in which is mixed turpentine and kerosene. As the seed spores will ripen on a severed limb, in all cases destroy the knot by fire.

He then speaks of the result secured by spraying with a solution of caustic potash all his trees. The efficacy of that is not so well proven as the cutting out. What he says is:—

The most advanced method and as practised by W. C. Archibald, Earnsccliffe Gardens, is to spray the trees once in the fall, and once in the spring, just before the leaves start, with a solution of caustic potash. This is not Gillett's lye, or soap lye. This mixture must not be used except after the leaves have fallen as it will injure the foliage. The intention by fall spraying, is to promote general cleanliness from all parasites and especially to kill the invisible seed spores that have in the summer or autumn dropped the embryonic black knot on the plum bark or buds; and, by the spring spraying, to damage the winter crop of spores before they ripen and disseminate their early seed. Good cultivation and feeding of the soil is also a prime factor in obtaining success.

Note.—Similar treatment of the apple trees with this caustic potash, is excellent for the destruction of bark-louse and parasitic fungi. Caustic potash is worth in bulk about ten cents per pound.

Mixture:—One pound caustic potash to five gallons of water. It may be used as strong as one pound to two gallons if applied with a brush or mop to the trunks only, of the apple or plum trees.

H. PERCY BLANCHARD,

Inspector of Black Knot.

Baddeck, Victoria County,
October 1901.

A. This is an excellent thing, drawing attention to facts well known, but not as well applied. After public attention was drawn to the matter, it had the effect, in Nova Scotia at any rate, of making some people do something where otherwise they might have left their orchards unattended to. The stirring up of an interest in a subject bearing on the welfare of all, must result in benefit to many. I am glad Mr. Ross has exhibited this poster.

THE HESSIAN FLY,—HOW TO GET RID OF IT.

By Mr. Robinson (Elgin):

Q. Would early sowing not prevent damage by the Hessian Fly?

A. No. The best remedy that I know of, is sowing later than the ordinary practice. In some experiments carried on at Guelph, by Prof. Zavitz, at the Ontario Agricultural College Farm, it was found that wheat sown on August 24 to 26, gave an average of 44 bushels to the acre. Wheat was also sown at varying dates after that until September 20, when 37 bushels was the average crop per acre produced under favourable conditions. That was only a loss of seven bushels of wheat for a delay of a month in sowing, and the advantage of an increased crop which can be produced by sowing early when there is no Hessian Fly, is much more than balanced by the loss caused by the Hessian Fly in years when that insect is prevalent, because early sown wheat is most liable to attack—the young plants being in a fit condition to receive the eggs when the female flies appear. Therefore, the later it is sown the better, so long as sufficient growth can be made for the young plant to stand the winter. I believe the best and most reliable way to secure a crop is, instead of sowing on the first of September, to delay until the end of September, at any rate during a period such as the present, when the Hessian Fly is rampant. Fall wheat may be sown at Ottawa very much later than September 1, with good results in many years, but occasionally an early winter does not allow it to make sufficient growth.

By Mr. Ross (Ontario):

Q. Does the Hessian Fly find food in other plants than wheat and barley?

A. No. Wheat and barley are the only food plants.

Q. Where does it germinate, if there is no wheat?

A. Nowhere. That fact makes late sowing so efficacious. The females come out in August and September. They are ready to lay their eggs as soon as they emerge, on any young wheat plants that are growing at the time, so that, by waiting until the end of September before sowing, the flies are all dead before the wheat comes up. That is the idea of sowing late.

By Mr. Robinson (Elgin):

Q. I suppose you have no trouble in noticing wheat when it is attacked by them?

A. No. It is very easy, if it is examined.

Q. It turns yellow?

A. First of all it is a very bright green, and before the winter has set in it turns yellow.

By Mr. Stewart:

Q. What would be the remedy to apply in the west where spring wheat is attacked?

A. The best remedy in Manitoba is cutting high, burning over the stubble, and also burning the straw after threshing.

Q. Or feeding it?

A. Yes, feeding, if you can feed it all before spring.

Q. That is pretty well done now.

A. It is more done now than formerly, and I believe it is largely responsible for the disappearance of the Hessian Fly. With more cattle all straw will be fed instead of burnt.

Q. In 1900, it was a dry year, and we had no Hessian fly. I do not know what was the reason, unless that the straw from the year before was thoroughly burned?

A. Yes, the insect disappeared then entirely. Information as to the proper steps to take was very widely distributed through the provincial department of agriculture. Mr. McKellar lets no grass grow under his feet as far as the farmers are concerned. Many burned over their stubble fields. This is a very useful practice, when it can be done, for the destruction of weed seeds, and there seemed an opportunity to do so in many districts that autumn. Most people also followed the advice given, and fed or burnt their straw before spring, so that a great many Hessian flies passing the winter in the flax-seed state in the straw were destroyed.

Q. These instructions were sent out pretty fully?

A. They were, and they were very well carried out, too. I may say this for the farmers of Manitoba: they are very wide awake and quick to adopt remedies when advised. It was the case with regard to the locust outbreaks. The ploughing down of all stubble before the young locusts hatched, and the applying of remedies as advised, were very carefully attended to, and excellent results followed.

By Mr. McGowan:

Q. What locusts were those. The ones that are due next season?

A. No. I think that what you refer to is the so-called 17-year locust, which is not really a locust at all. Its proper name is the harvest fly or Cicada. It has never occurred in Canada, and we are not likely to be troubled with it, although it will probably appear in Michigan and might come over our borders.

Q. In western Canada?

A. Yes. It is an insect with a curious life history; the larval period actually lasts for years, and the perfect insects occur in swarms, or pretty regularly at periods of 17 years. An occurrence of the insect is due next year in Southern Michigan, but we have never found it, as far as I am aware, in Canada, so I do not anticipate that we shall have any serious trouble.

THE PEA WEEVIL.

By Mr. Ross (Ontario):

Q. To return again to the pea bug, a number of farmers declare that the peas they sow are free of bugs, and they have the idea that the bug remains in the soil all winter and comes out in the spring to attack the peas?

A. That is a mistake; it does not remain in the soil, but it is a beetle which flies with great ease, and can come from a considerable distance. It flies to the field when the peas are in bloom, or a little later, and lays its eggs on the young pods. When the peas are in blossom, is the time that these insects fly to the fields, and it has been observed that they feed on the young plants. The eggs are laid on the outside of the pods, and the grub when hatched eats its way through the pod into the nearest seed

and remains inside it until it develops into a perfect beetle. There is only one weevil in a seed, and from the time the young grub enters it, it remains there until it is full grown. Many beetles in certain years emerge in the autumn, and they then pass the winter beneath rubbish, under the shingles of barns and outhouses and in other hiding places.

Q. Will they live outside the pea ?

A. Yes. They will if they get a suitable hiding place. Some years ago at a place near Picton, the name of which I forget at the moment, I found the Pea Weevil dead in enormous numbers under the shingles of a barn, where they had collected to pass the winter. The shingles were lifted up in a few places by the gentleman who took me to see them, and hundreds of them were found there. Large numbers of them had evidently emerged in the autumn, and had been killed by the winter. A season which induces this early emergence is a great advantage, because, when they do that, many of the beetles will be destroyed before they can do any harm. The usual method for these insects is to pass the winter inside the peas and they are then carried to the fields in the spring and sown with the seeds, when of course they infest the next crop. United action is no doubt the proper thing, and, if all farmers would fumigate their seed in the way I have stated, much good would be done and large numbers of this injurious insect destroyed.

Q. How do the bugs get air. There seems to be a solid cap over them in the pea ; they cannot live without air, can they ?

A. No.

Q. Then how do they get it ?

A. Enough penetrates through the skin of the pea. The quantity of air required is a difficult thing to decide upon. In this room it would be possible for us to live for a long time, even if it were closed up, because although it would seem to be air tight, air would be getting in all the time through innumerable imperceptible chinks.

By Mr. Erb:

Q. At what stage is it when it lays its eggs. Is it a beetle or a moth ?

A. A beetle.

THE PEA MOTH.

But there is another injury to peas done by the caterpillar of a moth, which never penetrates the pea, but eats it from the outside. Through the provinces of Quebec, New Brunswick and Nova Scotia the chief injury to peas is done by the Pea Moth, of which the egg is laid on the outside of the pea-pod, in the same way as by the Pea Weevil, but the young caterpillar, after eating its way in, attacks three or four of the peas on the outside, leaving large cavities in their sides and webbing them together with silk.

HOUSE OF COMMONS,
COMMITTEE ROOM 34,
WEDNESDAY, April 2, 1902.

The Select Standing Committee on Agriculture and Colonization met here this day at ten o'clock a.m., the Chairman, Mr. Legris, presiding.

Dr. James Fletcher, Entomologist and Botanist, of the Dominion Experimental Farms, was present by recall, and submitted the following evidence :—

THE SAN JOSE SCALE,—REMEDIES.

Mr. Chairman and Gentlemen, I would remind you that there has been rather a break in my evidence. I have already given part of what I have to say before the Committee. I dealt rather fully with the San José Scale question, showing that, although this insect must still be considered the worst insect we have ever had to deal with, the investigations by provincial and federal officers have been attended with a certain amount of success, so that we can to-day say, that there are three practical remedies which, although not thoroughly satisfactory, are so hopeful at any rate, that we may before long discover some treatment which will be satisfactory to all concerned. In the meantime these remedies which consist of spraying the trees with crude petroleum or with whale-oil soap or fumigating them with hydrocyanic acid gas, are giving paying results and it is worth while for all fruit growers to know what these remedies are. They are all detailed in the report of the Division of Entomology and Botany, printed in the general report of the experimental farms for last year. The effect of using these remedies of whale-oil soap and crude petroleum will be beneficial for many other insects and fungous diseases than those which I have indicated. The application of these remedies to trees, however, will require a certain amount of care and knowledge, and every effort is being put forth to help the farmers and fruit growers to use these remedies, with due care, so as to obtain satisfactory results. Now, as to the area infested by the San José Scale in Canada, the general statement may be made that there has been no great increase of those areas which were infested last year, although the insect has increased somewhat within those areas, and we have reason to believe that if the measures which have been advised and are being carried out by the Ontario Government are maintained, no increase in this insect will be reported. Moreover, great care has been taken by the Federal Government to prevent further introduction into the country of infested nursery stock, and the spread of the insect by this means. At the same time the provincial government is fully alive to the necessity of watching it carefully and continuously. Ontario is the only province where the scale occurs. The provincial inspectors of orchards and nurseries are doing their work in an excellent manner, and I believe everything possible is being done to stamp out this pest.

THE PEA WEEVIL.

The insect of next importance in Canada, and of which I spoke at some length at the last meeting of the Committee, is the Pea Weevil, better known under the name of the 'Pea Bug.' I do not hesitate at all to say that this insect is far more abundant than ought or needs to be the case. Its habits are thoroughly well known, and articles giving the best remedies have been published from time to time, in the newspapers, in the government reports, and the reports of this Committee, as well as in all the

agricultural papers. But unfortunately, in that part of Canada where this insect does every year a large amount of harm, the farmers themselves are not taking the proper amount of care. I am now arranging in accordance with the suggestion of the Chairman, made at last meeting, to send out a leaflet to farmers in the districts where the Pea Weevil occurs, and letters have also been written to the newspapers urging the farmers to treat their seed in the spring before sowing, which is the most practical remedy, as there are several members present to-day who were not at the last meeting. I will recapitulate what I said at that meeting.

The eggs of the Pea Weevil are laid by the female insect, which is a beetle, on the pea-pod; the egg hatches and the grub eats its way inside the pod, and then attacks one of the peas; it bores its way into the forming pea, and remains there for the rest of its life. The hole of entry is very small, and all trace of it soon disappears. In some seasons this insect becomes full grown and emerges in the autumn; but the general rule is that it remains in the seed during the winter, and in the spring is carried to the field, in the seed. There it hatches out among the growing peas, and attacks the crop again. A practical remedy is for farmers to treat the seed before sowing. This year it will be necessary to treat it in the spring, but the better treatment is to fumigate the seed as soon as possible after it is threshed in the autumn. The chief trouble is that seed peas are not always threshed so early as I am advising, because it has not been considered necessary in the past to do so; they have been kept in barns, and threshed during the winter as occasion permitted. But it will be far better for farmers in the future, now that the weevil has become such a serious enemy, to take special measures to control it, and if they live in a section where peas are infested to the extent they are now by the Pea Weevil, every farmer should treat his seed as soon as possible after reaping. The insect is not then either fully developed or in a torpid condition, and is more susceptible to injury with the remedy. Each pea, too, is injured to a less degree than later on, because all the time the insect is there, it is eating the substance of the pea. Nature provides in the seed pea as in the case of the seeds of all plants, a sufficient amount of food for the young plant, to sustain it and bring it forward so that the best results may be obtained. If, therefore, part of that food is destroyed by an insect, the strength of the plant grown from such an injured seed will be reduced. Common sense tells us that an injured plant can no more produce strong progeny than an injured animal. Many of the weevilled pease are injured in a vital part, the germ, and do not grow at all. When these circulars are sent out, I hope by their means to stir up an interest in the matter among farmers living in the districts where this insect occurs injuriously, so that they will fumigate their seed this spring, and again in the autumn before the winter comes on. There is always a tendency among farmers to think that it is of no use for one man to do what is right if his neighbours persist in doing wrong; but this is a wrong principle altogether, and there is every reason for farmers themselves to do what they know is right. In this particular matter, at any rate, I am sure more people will follow a good example than anyone has any idea of. The tendency in the world is, I believe, for most people to do what is right, and especially if a man thinks he is going to derive a benefit from his work, he will do so.

SPRAYING.

It is only 17 years ago that spraying fruit trees to protect crops from injurious insects was first spoken of in Canada. This was before the Nova Scotia Fruit Growers Association. The word spraying, with its present signification, was never heard in Canada before that, and now there are hundreds of thousands of people all over Canada who are spraying their trees as a regular practice.

By Mr. Wilson:

Q. What country did this originate in?

A. In the United States and in Canada.

Q. How long ago ?

A. Perhaps 18 or at most 19 years. It was adopted here pretty widely by progressive men 14 or 15 years ago, and possibly in the United States a little before that.

Q. We adopted it very early then ?

A. Yes, nearly at the very beginning of the work. Of course there were at first few spraying pumps suitable for the work, but directly the results were shown to be so satisfactory, spraying pumps were developed and improved till now we have in Canada some of the very best made. Mr. Fisher, the Ontario inspector of San José Scale, who has had wide experience in this work, made the statement recently that he considered, the best spraying pumps, taking all things into consideration, were two manufactured in Canada, the Spramotor Pump, and the Aylmer Pump. These are excellent pumps doing their work remarkably well. Of course it is the same with spraying pumps as with everything else, improvements are made constantly. These two will probably be improved from time to time in the direction of reducing labour and getting better results in the way of forming a very fine spray and applying it to the trees.

By Mr. Wright :

Q. Dr. Saunders recommended it about 16 or 17 years ago in the Horticultural Society in one of our western towns ; Mr. Ault, of Aultsville, took it up and applied it to his trees ; so he was amongst the first to take up the work here ?

A. As a matter of fact, I think probably Dr. Saunders was the first one that recommended the application of liquid poisons to trees, although it was done with a spraying pump at that time.

Q. I think that Mr. Ault was one of the first to use it on his trees ?

A. Probably so, I do not know ; but, as a matter of fact, the present Minister of Agriculture, the Honourable Mr. Fisher, was one of the first men I knew of who adopted the method systematically in his own apple orchard. He has always been an advanced fruit grower as well as a farmer.

Q. That is, in the province of Quebec ?

A. In any part of Canada.

Q. I was speaking of Ontario ?

A. It was adopted in all parts of Canada about the same time, and it was so successful that the good example of the first who sprayed was soon followed by others. It was a thing that explained itself, and showed the result of careful work so quickly that now it is a recognized part of every fruit grower's business. Every fruit grower can to-day certainly expect good results from his expenditure and work in spraying, but without it he can no more expect good results than without manuring or cultivating his orchard. The effects are so remarkable, that it may be justly said that the man who sprays regularly, reaps a benefit of 75 per cent in the value of his crop over the man who does not spray. As a proof of this, Mr. R. W. Shepherd, of Montreal, a successful and well-known apple shipper, who makes a specialty of shipping only first-class hand-picked apples, to England, which he packs in crates like eggs, has told me over and over again that he does not now, when buying, even apply to people who do not spray, because he knows he cannot get these 'A 1' apples which are necessary for his trade, from people who do not spray. He charges a high price, and gives for it first-class fruit ; he has men in England who know his name, and he cannot afford to send a single bad apple in these crates. He selects his men and they pick out and carefully pack every apple, and he probably gets twice the price of ordinary apples.

Q. He gets more than twice ?

A. Probably he does ; but, at any rate, he gets twice as much.

By Mr. Cochran :

Q. He gets the benefit, not the farmer who sprays, because he picks the apples particularly ?

A. He also gives a better price to the farmer who grows the fruit.

By Mr. Wright:

Q. He gives the results to the farmer.

By Mr. Cochrane:

Q. I would like to have his likeness ?

A. He pays a higher price, but he undoubtedly discards a great many apples, which sell for a lower price.

By Mr. McEwan :

Q. Has the farmer got a good dog where they pick apples like that ?

A. A good many generations back we required dogs to hunt our food for us ; but we do not now, and there are not so many in the world as there used to be. Things are better improved now. But to return to my subject, spraying is a useful practice, and has become general from fruit growers following a good example set by others.

THE PEA WEEVIL,—REMEDY.

Now, in regard to the Pea Weevil. This insect destroys an enormous amount of crop in Canada every year, and farmers are actually talking of giving up the growing of peas altogether. I cannot agree that this is a wise plan. The pea crop is too valuable, and it is not necessary. There is, I claim, a practical remedy which all can use. I repeat that the remedy, which is always effective and which is not difficult to use, is simply to fumigate the seed for two days with bi-sulphide of carbon. A simple way of applying this remedy, which I have recommended to farmers, and which has been adopted with a great deal of satisfaction by some who have tried it, because it is easy to use, and requires no special apparatus, is the following :—

Put into an ordinary coal oil barrel five bushels of peas ; the barrel will just hold that quantity which will weigh about 300 pounds. The standard weight is 600 pounds, but peas run over that, 60 to 65. The barrel will hold about 300 pounds of peas. One ounce of bi-sulphide is required for every hundred pounds of seed ; so three ounces of bi-sulphide of carbon is sufficient to destroy every insect in that quantity of peas. All that is necessary is to put the barrel in a shed out of doors, and put the bi-sulphide in a small vessel on the top, or pour it directly over the peas, then put a sack over the barrel ; a damp sack is better, because it is closer ; and then put boards on the top, to close it tightly.

By Mr. Wright:

Q. That is, cover over the barrel ?

A. Yes, to close up the barrel tightly. When the bi-sulphide vaporizes, it produces an exceedingly inflammable gas which will ignite if a fire or flame or even a lighted cigar is brought near it. That is why it should be done in an out-of-doors shed, but there is no doubt that with proper care this work can be done without danger.

By Mr. Wilson:

Q. Why not do it out of doors ?

A. In a shed out of doors.

Q. Why not in the open air ?

A. It is not necessary to have the shed, but the shed would keep rain off, in wet weather.

By Mr. Cochrane:

Q. Would that be any good without the whole of the farmers in the community adopting it?

A. Yes, I think so.

Q. My experience last year was that I went forty miles to get peas without any bugs in them, but my crop was just as bad with bugs as any of my neighbours?

A. It was probably a very great benefit. Your action probably made people think. Before you came in, Mr. Cochrane, I maintained that every man should do what he could in these matters, and others would follow his example.

Q. There are as many bugs in my peas as in the peas of any of my neighbours?

A. It takes some time to get these measures adopted generally. I cited, for instance, that spraying was only introduced about 17 years ago, and now it is adopted all over the country. The results are so good from fumigating peas, and you have the satisfaction of knowing that there are no bugs alive in your own seed peas; so, any bugs that attack your pea crop must come from some other farm.

Q. What satisfaction is that to you if you lose your crop?

A. You only do that for a year or two, at first. It is a matter that is being agitated, and an effort is being made to get everybody to do it.

Q. Would it not be better to educate the people on that line to have it adopted generally?

A. We are trying to do that; that is the reason I am bringing the subject before the Committee.

By Mr. Wright:

Q. If the peas were threshed as soon as possible after being harvested, they would be free from weevil?

A. They would have the weevil, but it would then be very much smaller than left alive till the winter.

Q. I didn't think that would be the effect at all?

A. Yes; the grubs would have attained considerable size before harvest. The Pea Weevil is a beetle which flies to the crop and lays its eggs early in the season, and the grubs grow all the summer. Because you sow seed which is free from weevil, that is no certain guarantee that you will not have some weevil in your peas; but I maintain that if one man will take proper precautions, others will do so also, and that the benefit gradually will increase. The very talking about it, the very bringing up of this discussion, must do good, because it brings to the notice of people the fact that, when you take every precaution, good results will follow; and, although at first a man may not succeed because others do not take these precautions, still the mere fact of his doing so will induce others to adopt the same measures, and in this way the practice will become much more general; then the effects of the work will be more marked, and I see no reason at all why this pest should not disappear entirely.

By Mr. Cochrane:

Q. There is an idea prevalent in our country that if everybody gives up the raising of peas, and none are sown in the country for a few years, the weevil will disappear?

A. That is probably true; but we cannot do without peas; they are too important a crop. The crop of the whole country would have to be given up. The beetles can fly a long distance; and 30 or 40 miles would be nothing for an insect to fly.

By Mr. McEwen:

Q. It would not fly that in one spring.

A. Undoubtedly. Have you ever noticed the rate at which an insect flies. If you notice when you are travelling in a railroad train you will see butterflies sailing along—

side a train without the least difficulty, and a fly will fly from one end of a car to the other when the train is going 40 miles an hour, without the least effort, going the same rate as the train with the speed it flies to the end of the car added.

Q. It would fly along with the train all right, but I would think that in flying across the country it would fly over the woods and would get caught in bushes and so on. I would not think it could go in one spring as far as you say?

A. An instance of the rapidity with which insects can spread is afforded by the recent rapid distribution through the west, of the White Cabbage Butterfly which for many years has destroyed so many cabbages in eastern Canada. It was very plentiful in Manitoba a few years ago; then it appeared at Calgary, and later, in 1899, at Kaslo, on Kootenay Lake, in British Columbia. It had not up to that time appeared on Vancouver Island, but in 1900 it was abundant, and the caterpillars injured the cabbages from one end of the island to the other. This insect can only spread by flying, and its delicate wings render this more difficult than would be the case with the Pea Weevil, which is a very active beetle, and I have no doubt can fly long distances. This discussion will, I hope, have the effect of doing what I now desire most to do, namely, bring the subject before the country so that something may be done which will reduce the numbers of the Pea Weevil. United effort is needed, and if the ordinary Canadian farmer is told that something of a practical nature can be done, which will enable him to save a large proportion of one of his most important crops, he usually does what is suggested. It takes some time to get useful remedies adopted generally, and I think that we shall get good results from this opportunity of bringing the matter before the Committee.

Q. You do not wet the peas before fumigating them?

A. No.

Q. You just put in the dry hard peas?

A. Yes.

By Mr. Kidd:

Q. How long would you leave them in the barrel?

A. Two days.

By Mr. Cochrane:

Q. Is there any remedy to keep the bugs from eating the peas during the winter. For instance, if you get your seed and the bugs are in it all winter till the spring, is there any known remedy to kill the bugs and prevent them eating the peas all winter?

A. That is the effect of the remedy I have just given. The beetles do not come out of one pea and then attack another; the only time they can get into the pea is when they are small grubs and the pea is green and soft. If peas are fumigated directly after harvest much less harm is done.

By Mr. Kidd:

Q. There is no need to disturb the peas in the barrel?

A. No. But you can fumigate them as well in bins, and in larger quantities; I only mentioned a barrel because it is an easy way for the ordinary farmer to fumigate his own seed. There is a big seed house at Picton, in Prince Edward County, where they treat hundreds of bushels at a time, in a specially built chamber. I treated this matter fully in my report for 1890.

By Mr. Cochrane:

Q. Can it be done in bins as effectively as in barrels?

A. Yes, if the bins are tight.

By Mr. Kidd:

- Q. But you do not need to move the barrels if you do them that way ?
A. No.

By Mr. Robinson (Elgin):

- Q. How much do you use ?
A. One ounce to a hundred pounds.

By Mr. Wright:

- Q. What is the name of the remedy ?
A. Bi-sulphide of Carbon.
Q. What is the price of it ?
A. The price varies according to the quantity purchased, but it is about seventeen cents a pound in large quantities.

By Mr. Cochrane:

- Q. Is there any such thing as bugless peas ?
A. No, with the exception of the so-called Grass pea, which is not a true pea.
Q. Parties up our way say they have bugless peas, but I do not think, myself, they are.
A. There is no such thing.
Q. It may be that the peas have been treated in the way that you speak of ?
A. Perhaps, but there is no true cultivated pea known which will not be affected

THE GRASS PEA.

There is the grass pea, of course, which is not attacked, but it is not a pea at all, although it answers many of the purposes for which peas are grown. When cut green, it is good for fodder, and it produces a crop of seed varying from 10 to 30 bushels to the acre. It is being grown very largely in some pea districts on account of its immunity from the weevil. This year Dr. Saunders is going to send out some of the seed in our regular seed distribution. It has not succeeded very well with us in years past. At Ottawa last year it did not ripen, so it is not a plant that we can adopt at once without a little more experimenting, but, where it can be grown, as west of Toronto, for instance, it has given satisfactory results.

By Mr. Robinson (Elgin):

- Q. Is it like a pea or vetch ?
A. It belongs to the same family as the bean (*Lathyrus*), but has small pea-like flowers which are white or bluish purple, and grows with a slender grassy vine 2 to 2½ feet high, producing small pods with about two seeds in each.
Q. It is a vetch ?
A. It is not a true vetch. Its proper name is the Vetching Pea (*Lathyrus varius*). It has been introduced from Asia, and is much grown in India.

By Mr. Cochrane:

- Q. Is it hard on the soil ?
A. It is a leguminous plant and takes a good deal from the soil, but like clover, it pays back more than it takes, on account of its power to collect nitrogen.

Q. Would the same soil that produces good peas grow it ?

A. Yes.

Q. Where can it be got ?

A. The seedsmen in Hamilton keep it now. It can be obtained from the western houses.

By Mr. Wright:

Q. Is it similar to the cow pea, grown on the other side ?

A. No, that is a different thing, which will not ripen in Canada, except in favoured sections.

DISTINCTIVE DIFFERENCE BETWEEN THE "PEA BUG" AND PEA WEEVIL.

There is no use fighting against a thing when once it has become generally adopted, but I cannot neglect to point out to the Committee that the word 'Pea Bug' generally used is misleading. The word 'bug' is used for any sort of insect. There are three different insects which all go under the name of 'pea bug' with farmers in different sections. There is first of all the one of which we are speaking, the true Pea Weevil; and the word 'weevil' is a term which has been recognized by everyone for many years as belonging to the beetle family. This is a beetle, and 'weevil' is the proper name.

There is besides also the Pea Moth. This is found all through the province of Quebec and in the Maritime Provinces. This insect attacks the green peas in the pod as a caterpillar. The parent is a moth which lays its eggs on the pods, and from these hatch the caterpillars, which cause 'wormy' peas. This has different habits from those of the Pea Weevil. The Pea Weevil spends the winter inside the seed-peas, while the caterpillar of the moth leaves the pods and passes the winter in the ground, so that the treatment I have just described for the Pea Weevil would not answer for the Pea Moth.

Another insect, also spoken of as the 'pea bug,' is the plant-louse, which appeared suddenly in 1899, and for two years caused enormous loss, but last year it disappeared entirely. No treatment of the seed will have any effect on it at all. The proper name of this insect is the Destructive Pea Aphis. I do not mean to try to get people to give up the name 'pea bug,' but I do ask them not to call other things by the same name. It is not the right name for the Pea Weevil, but let them stick to it, if they find it easier, so long as they will not call other things by that name when they write for information. There are plenty of books which give the right name, but the word 'bug' seems to have got into general use for everything in the shape of an insect. I take every opportunity to give the right name for the Pea Weevil, and, whether I am talking of it or some other insect, I draw attention to the proper name of what I am talking about, so as to get people familiar with the proper name.

By Mr. Ross (Ontario):

Q. You say there are three insects; you have given us two, the Pea Weevil and the Pea Moth ?

A. They are the Pea Weevil, the Pea Moth, and the Destructive Pea Aphis. The plant-louse I have just spoken of, belongs to the aphis family; they are also known as Green flies.

Q. How does it affect the plant ?

A. It clusters in large numbers on the young shoots and flowers. The loss throughout the United States last year, and in 1899, when it appeared for the first time, was several million dollars.

Q. Have we any in Canada ?

A. There was great loss in 1899, and some damage the year before last, but not any last year.

By Mr. Kidd:

Q. At what time does it strike the plant ?

A. When the plants are in flower, and it remains on sweet peas right up to the autumn. It has now disappeared, and, from the fact that it was never observed until 1899, I hope that it will lie many years before it appears again.

By Mr. Ross (Ontario):

Q. You are taking steps to spread this information about the means of treating the pea bug ?

A. Yes. Your suggestion has been carried out, and we have prepared a leaflet on the subject. The remedy is well proved, and is a practical one, which anyone can apply for himself.

THE POTATO-STALK WEEVIL.

During the past year there were two new insects which appeared in Canada that we have not had to deal with before. I am glad to say neither of them is of very great importance. One of these also is another kind of weevil, the Potato-stalk Weevil, which attacked the potato crop, on Pelee Island, where potatoes are an important crop. The year before last they exported about 30,000 bushels of potatoes, but last year there was not a single bushel exported, because this insect appeared and destroyed the crop to such an extent that they have hardly enough for their own use. It is a small beetle, that lays its eggs in the stem of the potato. These eggs hatch into little grubs, which burrow up through the stems, and, the stalks and leaves being destroyed, no potatoes can be produced, because the potatoes are formed from the nourishment which is taken in through the leaves, where it is converted into starch and stored away in the tubers. The stems having all been destroyed, no potatoes could be formed. This insect passes the winter in the potato stems ; so, if these are all burnt at once when the crop is dug, the insects are all killed.

POTATO ROT.

By Mr. Wilson:

Q. In our district there was a large quantity of potatoes rotting in the cellars last year. What was the cause of that ?

A. That was probably the potato rot, a fungus disease.

Q. Is there any way of remedying that ?

A. Undoubtedly. It is a disease which can be controlled to a very large extent by spraying the potato vines during the summer, with Bordeaux Mixture. It appears about the first of August, particularly in low lying localities where there is not very good drainage, and where the water lies, so that the air is damp.

Q. How can you tell when the disease is attacking the potato ?

A. It shows itself as rust on the leaves, about the first of August, and you can tell at once by the musty smell from the fields. The potato rust appears at that time, and the rust on the leaves is exactly the same disease in another form as that which later in the year develops into the potato rot of the tubers. It appears first on the

leaves, and the odour of the disease is easily detected when passing a diseased crop, particularly early in the morning or late at night, in muggy damp weather; that is the time when this disease is developed quickest, and spreads. Its first appearance is as a downy mildew beneath the leaves. Here the spores, minute bodies analogous with seeds, are borne, and from these subsequent infestation comes; these are blown on to other plants located near the injured plant, where they produce more rust. At the same time many of these spores fall to the ground, and by the first rain are washed down into the ground, where they reach the tubers, and the rot sets in. Like many other fungus diseases, conditions favourable for its development may not be present; the spores may simply fall on the outside of the potato, and if we have clear dry weather, they may go into the root-house with the potatoes and never develop at all. In such cases we may have a good deal of rust, but no rot; but at the same time they may develop, and generally do. When you find rot developing, late in the autumn after the potatoes are put into the root-house, then it is simply because the conditions are favourable for the growth of the parasite. In a well ventilated root-house there is less danger than in one where the ventilators are closed, and it becomes hot and muggy. There is no way in which you can prevent this loss better than by spraying the potato foliage about the first of August with Bordeaux mixture, which is a mixture of blue-stone, lime, and water, and is very destructive to all fungus growths. This destroys the rust or prevents its spread to other plants in the field. We have found at the Central experimental farm, where we have carried on experiments for many years, as object lessons, that where potatoes had been sprayed on a strip right through the middle of a field, potatoes which are sprayed will hold their leaves five or six weeks longer than those close to them, which were not sprayed. By the first of September many potato fields are brown, and all the leaves are dead. This is not because the leaves are ripened, but because they have been killed by the disease. The potatoes of sprayed plants in the same field are twice the size of those of the plants of which the leaves have been destroyed by the rust. This is because the leaves are preserved so much longer in a green condition, and continue all the time doing their work of manufacturing starch and storing it up in the tubers.

By Mr. Ross (Ontario):

- Q. You say you can smell the rot in the field?
- A. You can when it is in the rust stage on the foliage.
- Q. Is that fungus injurious to the animals that consume it?
- A. They cannot consume it, because when the disease is developed it rots the whole tissue of the potato; but, even when the spores are on the potato, if the potato does not rot, it is perfectly sound, because the disease has not worked into it. As soon as it begins, the potato very soon turns into a liquid rotten mass.
- Q. Then the fungus is not injurious to cows and horses?
- A. No, unless the tuber rots; it is then. The spores are so infinitesimally small; they are absolutely invisible to the unaided eye. If potatoes begin to rot in the root-house, they should be picked over and the sound ones used at once.

POTATO SCAB,—TREATMENT.

By Mr. Robinson (Elgin):

- Q. Do you suffer anything from the potato scab?
- A. We do. This again is another fungous disease which is easily controlled by soaking the tubers before planting in a solution of Formalin. I prepared some years ago, with the Horticulturist, what we call our Spraying Calendar, this gives in a

concise form the standard remedies for the more important crop pest-insects and fungous diseases, with the way to prepare and the best time to apply them.

The last item on this calendar, as you will see, gives the treatment of the Potato Scab with formalin. It is an easy remedy, and consists of immersing the tubers before planting, for 2 hours in a solution of 8 ounces of commercial formalin in 15 gallons of water. Formalin is not poisonous, and is the same remedy as has been used very successfully in treating seed grain against Smut.

Q. That is applied to the potato crop?

A. No, to the tubers, to the seed potatoes before they are planted. The scab fungus attacks the outside of the potatoes, and sometimes is only a roughness on the surface; but in bad cases it will burrow down into the potato from a quarter to a half inch, and in such cases it is necessary to leave the potatoes soaking longer; but two hours is sufficient for most cases. The infectious nature of the potato scab is not recognized as much as it ought to be; it is a particularly infectious disease.

By Mr. Wright:

Q. Are these pamphlets available now?

A. They are.

Q. And within the reach of everyone. What do you call it?

A. The Spraying Calendar. We are glad to give copies to anyone who will use them. The scab is so exceedingly infectious that sacks or bins in which potatoes infected by the disease have been kept, should never be used for seed, because potatoes put into such sacks are liable to be infected. In choosing potatoes for seed, it is well to choose them as nearly as possible of medium size. The most successful way to grow this crop is to choose potatoes of medium size and put them in the ground whole. If a sufficient quantity of seed can be got easily, without putting too much work on the selection, it is the best plan. In small plots, we can do it, and we find that we get the best results from medium-sized potatoes planted whole. In the west, particularly, cut potatoes will frequently dry out before the plant becomes established, whereas the whole potato has sufficient resistance to make its growth, and give it support without injury from drouth. In British Columbia and the North-west, cutting potatoes sometimes causes a considerable loss from the seed drying up, whereas, if put in whole, better results may be obtained.

Q. What is that pamphlet you referred to?

A. The Spraying Calendar.

Q. It can be got here, can it?

A. Oh, yes; it is issued by the Farm here.

Q. Then we can apply to the Farm for copies?

A. Yes; if you will give me the names of those you would like to have it, we will send it to them gladly.

THE EXPERIMENTAL FARM AS A BUREAU OF INFORMATION.

Mr. Ross (Ontario).—I should like to tell the Committee that I wrote you last year about the treatment of some shrubs, and you sent me one of these spraying calendars. I may say also that when ladies have come into the store and complained about their chickens, in the spring, having lice on them and various other troubles, I have sent down to the Farm; they have thus had sent to them recipes which have been successfully applied, and they have been delighted. In one case, which will illustrate what varied information can be got, a man came in and was telling about a disease that his horse had. I wrote down to the Farm, although it was perhaps a matter more for the farrier; but they sent back a recipe, and information which was quite satis-

factory to the man, and his horse recovered. These things are quite valuable, and it is expected that we may avail ourselves much more freely in future of the information they may have at the Farm.

By Mr. Wright:

Q. These pamphlets may be had in any number, I suppose?

A. Certainly. If we have not enough, we can always get them. The demand is what regulates the supply. I am very much obliged to Mr. Ross for his kind words, and I may say that all the officers at the Farm are enthusiasts in their work, and always glad to reply to any communications.

Mr. Ross (Ontario).—There is another thing I might mention. About three weeks ago, one of my customers in the store, said, 'I wonder if I can get from the Farm at Ottawa a plan to put troughs in my stable for watering my milch cows, for giving water to them.' I said, 'Yes,' and I wrote to the proper official at the Farm, who prepared a very nice plan, showing in detail how the water would be carried through. The water was already in the barn, but my customer wanted it distributed to the cows. The man was delighted with the courtesy he received, and the information given. The information is to be had, and I think we should avail ourselves of it; that is what the Farm is for.

By Mr. Wright.

Q. I do not think the people generally know of the extent to which they can obtain information.

A. I am glad to say, gentlemen, that the farmers of the country are making more and more use of the Farm every year. We have a good many correspondents. In my own small, but important branch, there were over 3,000 people who wrote last year, for information about bugs and weeds, as they are generally called, and it may interest the members to hear that at the experimental farm office this spring, during the time the applications for seed grain were coming in, the number of letters received varied from 800 to nearly 2,000 letters a day. This shows that an interest is now taken in the farm work throughout the country, which is certainly most encouraging to us.

Q. It is increasing every year?

A. Yes; increasing every year.

THE POTATO STALK WEEVIL.

Q. With regard to that Potato-stalk Weevil; what is the remedy?

A. It is very simple, and one that should be known by every one, because this insect may appear in any part of Canada. It has as yet only appeared for the first time in that southern district of Lake Erie. The remedy is this: The weevil lays its eggs in the potato vines and the young grubs burrow inside the stems till the autumn, and like the Pea Weevil, remain there where they developed, until the next year. The simple remedy is to destroy and burn up all the stalks, instead of pitching them to one side or ploughing them in. If destroyed by burning, you not only get the stalks which are beneficial for the land; but you get out of the way every kind of insect or fungous disease which passes the winter in them. The insects pass the winter in the stems only, and there is no reason why they should increase if all the stems are destroyed promptly after the crop is dug.

Q. That would be a wise precaution to take every year ?

A. Undoubtedly, particularly in garden practice ; it is so very easy, and it certainly is the best plan to destroy all tops, of every kind, directly the crop is secured. You do not lose anything, you get all the ashes, the chief part of their value, and if the land is so heavy that you want it mechanically lightened, you can get a better substance than the stems and leaves of plants, which are always liable to carry insects or fungous diseases, liable to appear again and attack future crops.

FORMULA FOR POTATO ROT.

By Mr. McLennan:

Q. Did I understand you to say that bluestone and lime is dusted over or applied in solution to potatoes for the rot ?

A. It is in solution, sprayed over the foliage. In the spraying calendar a very precise and brief description of every operation is given : 6 pounds of bluestone, 4 pounds of lime, and 40 gallons of water, and it is to be sprayed on the vines about August 1, the time the rust first appears. It destroys the rust and prevents it spreading, and also protects the tubers from the rot, which is another form of the rust.

THE GRAPE-VINE COLASPIS.

There is another insect which was reported for the first time in Canada last season. A little beetle called the Grape-vine Colaspis, which attacks the grape vine, appeared in the Niagara District, and did some harm, but the damage was not very serious. It attacks generally cuttings, the young vines, before they are thoroughly established. The beetle simply eats the leaves and does a certain amount of harm. The grubs live on the roots of strawberries. About the end of June the beetles emerge and fly to the grape vines, of which they eat the leaves. Towards autumn they fly back to the strawberries, lay their eggs, and the grubs injure the strawberry plants to some extent by feeding on the roots.

IMPROVED CULTIVATION OF STRAWBERRIES.

There is no reason why it should do serious damage to strawberries, because the new method of growing these berries is to take only one crop from the beds, instead of leaving these for several years as formerly. Mr. Macoun tells me that he has tested this plan and has found that he gets the best results from planting young runners in spring. By autumn good strong plants have formed, from which the crop is picked the following summer, and the beds are then ploughed down. If you want more plants of some variety, you can leave the beds for another year ; but to get large berries the single crop method is the best, and all beds should be ploughed down after two crops of fruit. This method is important in my work, because some of the worst enemies of the strawberry propagate for the most part in old beds. Under the new method, they have not time to complete their stages before the beds are ploughed down. An instance of this is the destructive White Grub which passes two years as a grub.

In Nova Scotia, again, for some years an insect known in England as the

BLACK GRAPE VINE WEEVIL.

has locally done much harm in old strawberry beds. The name I have mentioned was given to this insect many years ago in England, because it attacked grape vines. In this country, up to the present time, it has done no harm to grapes, but it is not wise to change the name.

By Mr. Wilson:

Q. I did not quite catch the plan for the raising of strawberries. You plant the runners in spring and get the crop the following June ?

A. Yes ; the plants bear a good crop the next year. A second year is permissible if the beds are not attacked by insects ; but the one year cropping of a bed pays best.

Q. But you can allow them to run two years if you wish ?

A. Yes, if you wish to do so.

Q. You think they should be ploughed up every year to get the best results ?

A. Yes, and particularly when insects are troublesome. You can get bigger and better berries, and it is easier to keep the land clean of weeds. Some varieties of strawberries, which do not make runners freely, require to be left for two years. In favourable seasons, by planting the young runners in August, a partial crop may be gathered the first spring, and the big crop taken the next year ; as a rule, however, the season here is too dry for this to be advisable.

HOUSE OF COMMONS,
COMMITTEE ROOM 34,
THURSDAY, APRIL 3, 1902.

The Select Standing Committee on Agriculture and Colonization convened here this day at ten o'clock a.m., Mr. Legris, Chairman, presiding.

Dr. James Fletcher, Entomologist and Botanist of the Dominion Experimental Farms, was present, by re-call, at request of the Committee, and made the following statement in continuation of his evidence.

THE PEA WEEVIL.

By Mr. Richardson:

Q. Before you commence your evidence, Professor Fletcher, I would like to make a brief statement in reference to the methods by which the Pea Bug or Pea Weevil may be carelessly spread throughout the country. We have never had it as a pest in the section of country where I reside, but last fall at our annual county show, in passing through the grain department, my attention was called to a very fine sample of peas that had been brought in by an exhibitor from a distance. I examined the peas, took up a handful of them, and I noticed a hole in many of them. When I broke open the peas, I found there was a good-sized live pea bug in each one of them, in which there was a hole, and I suppose these bugs would be much larger in a little while. These peas have been sold for seed, and have, I am afraid, introduced the pest into a part of the country in which it had never been known before; I mention this in order that, if possible, some practical method may be used to prevent the spread of the pest?

A. No doubt the Pea Weevil is introduced into new sections of the country in the manner in which Mr. Richardson has suggested. May I ask whether these peas were grown at any great distance from the place where you saw them?

Q. They were grown 20 or 25 miles away.

A. Yes, that explains it. Your district is just outside the district in which the insect is known to have done harm, and this is a case where it might be introduced into a new district which is near enough to its range for it to do a great deal of harm. That shows the importance of treating all the seed peas before using them as seed. The remedy for the Pea Weevil is very easy of application, and it only requires the attention of the public to be drawn more to it, to have the necessary precautions taken by which the seed would be always tested and treated before being used by farmers. It is the duty of everybody interested in this very important crop, to draw attention to the manner of treating it whenever an occasion arises. That is the very great benefit of this Committee; the different members come here and take an interest in what is discussed, and, at any rate, each one of these goes home with the idea that he can do some good in bringing the attention of those farmers in his own neighbourhood to what has been done and can be done in the way of destroying these agricultural pests. A great deal of the spread of the Pea Weevil in Canada is due to the supineness of farmers who think that nothing can be done to prevent it. It is impossible to give up growing peas in Canada; they are too important a crop, and moreover there is no need to do so, because the remedy is a simple and practical one, which can be used by everybody as soon as they see the importance of doing so. The man who sold

those peas, I have no doubt, did not think it was an important matter. You did not get into conversation with him at all, did you?

Q. I did?

A. And he probably thought you were taking too much on yourself, I suppose, by drawing public attention to the fact that his seed was infested. This is generally the view taken by people who have this pest in their crop, and the very fact of his taking the sample to an exhibition shows that he did not feel, to a proper or right extent at any rate, the danger of loss to which he was exposing his own crop and that of his adjoining neighbours, by bringing these peas and distributing them in that district.

The proper remedy for the Pea Weevil is, as I have before stated, Bi-sulphide of carbon. It is a cheap material, and the most practical remedy. There is but a slight danger in its use, and that is really generally exaggerated, and is easily avoided by ordinary precautions. Fumigation should always be done out of doors or in a shed, not in a close building, because of the inflammable vapour which is given off.

FORMALIN,—HOW TO APPLY IT TO SEED POTATOES AND SEEDGRAIN.

I have been asked by a number of the Committee to again speak of the use of formalin for destructive fungous diseases. It has been found, as I stated at the last meeting, very useful in the treatment of potato scab, a fungous disease which is carried on the tubers and which can be almost entirely prevented by treatment of the seed potatoes before they are planted. The same very convenient remedy has been found extremely useful for destroying smut in small grains. It is more effective than the old remedy of treating the seed with bluestone or sulphite of copper. Formalin is also a much more easily prepared remedy, and is used in the proportion of 8 ounces to 15 gallons of water; the solution may be used over and over again until it is all used up. The seed is simply submerged in this, and kept submerged for two hours.

By the Chairman:

Q. For how long?

A. For two hours. The grain is of course swollen after this treatment, and has to be dried before it can be sown with a drill, but the same was the case with the old bluestone remedy. It has been found a very useful remedy, particularly in Manitoba and the West, where it has been used more largely than in any other part of the country. The formula, as given on our spraying calendar, is as follows:—

For potato scab, soak the tubers either—

1. For two hours in a solution of commercial formalin (formaldehyde) 8 ounces in 15 gallons of water, or,—
2. For one and a half hours in a solution of corrosive sublimate, 2 ounces in 16 gallons of water. When dry, cut up for planting.

Formalin has the advantage of being neither poisonous nor corrosive, while corrosive sublimate is a fatal poison, if taken internally. It also corrodes metals. The solution should therefore be made in wooden or glazed vessels. All treated seed should be planted, and any solution left over should be poured into a hole in the ground.

For smut in small grains soak the seed for two hours in the above solution of formalin (1),—one ounce to one bag.

CANKERWORM.

There are just one or two insects I wish to draw particular attention to this morning ; one is the insect known by the name of the Cankerworm, which is too well known to all fruit growers, but which is not given the attention it ought to receive, on account of the injury which it does. Probably, after the San José Scale, it is the fruit insect that just now, in western Ontario, is doing more injury than any other. The female moth, which is rather different from most moths, in that it has no wings, has a body something like a spider, and its habits are as follows :—

The moth, of one of the two varieties found in our orchards, passes the winter under ground as a chrysalis, and in the spring emerges and climbs up the trees to lay eggs. There are two kinds, both very similar ; one of these emerges in the autumn and the other in the spring ; the caterpillars hatch about the same time in the early spring, and at once attack the foliage, doing a great deal of harm. These are easy insects to control, if attended to, because, the moths not flying, the only means of their increasing in an orchard is by the females climbing up the trees and laying their eggs on them. They cannot, like other moths, fly to the trees from a distance, or from neighbouring orchards. Therefore, any thorough treatment by which an orchard is cleared of these pests, leaves that orchard free from attack for a considerable time afterwards. The insect is frequently not recognized as the cause of serious injury until it has become very abundant. When it becomes apparent, fruit growers then know, too late, that it has destroyed their crop of fruit. Even when present in small numbers, in any number at all, the Cankerworm should be promptly attended to. If not, the whole of the foliage may be stripped off.

REMEDIES FOR CANKERWORM.

One remedy is spraying with an arsenical poison ; perhaps the most convenient is Paris green, and the best known. This is used in the proportion of 1 pound to 160 gallons of water, that is 1 ounce to every 10 gallons of water, which is a sufficiently strong remedy for this insect, when the caterpillars are small ; but it must be applied early in the season, because when the caterpillars are larger, a stronger mixture is required, and more of it, which may injure the tree.

Another remedy is capturing the female moths. The caterpillars, when full-grown, fall to the ground and having burrowed down a short distance, change to the chrysalis form, from which the moths emerge later. The females having no wings, have to crawl up the trees. The plan generally adopted to prevent this is to put some adhesive matter on the trunks which will not injure the trees, but will catch the insects on their way up to lay their eggs, in the same manner as fly papers catch flies. The mixture used in Ontario is practically the same as that put on the sticky fly papers, castor oil and resin. This is an exceedingly sticky substance, and no insect can climb over it ; and it retains its viscid, sticky condition for several days. The proportions for use in warm weather are 2 pounds of castor oil to 4 pounds of resin. When the weather is cold, the resin is decreased by one pound, making 2 pounds of castor oil and 3 pounds of resin. These are boiled together and they form a very sticky mixture, which can be painted on paper bands to be tacked upon the trees, and remains effective for many days.

By Mr. McEwen :

Q. What time do they go up ?

A. Late in autumn, and early in the spring, according to the variety occurring in the orchard.

Q. They would be moving now !

A. Yes, or very soon.

By Mr. Robinson (Elgin):

Q. This remedy is castor oil and resin ?

A. Yes.

By Mr. McEwen.

Q. Is that the kind of worm that gets into a kind of bag upon the trees ?

A. No ; that is probably the Tent Caterpillar, which was so prevalent all through Ontario three years ago, but which has disappeared now in most places. The canker-worms did great damage last year, and I am trying to get fruit growers aroused to the danger of neglecting them.

Q. This insect remains around the foliage and has no tent ?

A. No ; they have no tent ; they remain on the leaves and eat them until there is hardly a skeleton left. Badly infested orchards turn brown in June from the effects of the ravages of these insects ; the fruit then fails to form, and the crop is lost ; at the same time the trees are weakened, which affects the next year's crop.

APPLE BORERS,—REMEDY FOR.

The apple tree borers are doing great damage also in some parts of Canada. The usual remedy for these is to wash the trunks of the trees with a strong alkaline wash, ordinary soft soap or whale-oil soap diluted with a saturated solution of washing soda, to the consistency of ordinary oil paint. If this mixture is painted upon apple trees, with a white-wash brush, about the beginning of June and again about the end of that month, it forms a varnish-like coating, which prevents the female beetles from laying their eggs. We have found on the Farm that it is an effective remedy if applied regularly, and we have no borers in our trees. However, in some parts of Canada it is claimed that borers are so abundant that this remedy is no good. For such places, to the above may be added carbolic acid, but some claim that even this is not enough, so we have to look for something more effective still. The introduction of the use of crude petroleum and whale-oil soap as a remedy for the San José Scale will, I believe, have the effect of preventing this insect from laying its eggs on the tree. If so, some good, at any rate, may be done as a slight offset against its great injuries.

THE PEACH BARK-BEETLE

is an insect which has been doing great damage in the peach districts for many years. Last year whale-oil soap and crude petroleum were both used against it, and it was found that both prevented the beetles from entering the bark. This little insect bores into the bark early in the spring to lay its eggs, and increases very rapidly ; there are two broods in the season. The presence of this insect is noticed on the trees in winter by the large amount of gum which, on wet days, oozes out from the bark, where it has been attacked. The gum is said to be found sometimes in such large quantities as half a gallon, at the foot of a single peach tree. This takes a lot of strength away from the tree, and unless the injury is stopped, the tree must die.

THE BIRCH SKELETONIZER

is another insect which aroused much interest in most parts of Ontario, from Manitoba throughout the province of Ontario, and half way down to Quebec, last season, was the caterpillar of a small moth which stripped the birch trees of their leaves. It destroyed the cellular tissue of the leaves so that many of them fell and left the trees leafless by September. This was very injurious, and if the visitation were repeated another year, would greatly injure the trees. We hope that it will not reappear; in 1892 there was a very serious outbreak similar to that of last season, when the caterpillars stripped all the birches in Ontario, but the following year hardly a specimen was to be found.

THE BEE MOTH, OR WAX MOTH.

An insect which has been very much inquired about is the Bee Moth or Wax Moth, which lays its eggs in bee hives. The caterpillar feeds on the wax, and is very injurious. There is an article on this insect in my annual report for 1901. It has been found that a very simple remedy for cold districts is freezing the combs. If empty combs are stored where they are exposed to the cold of winter, all the Wax Moth caterpillars will be killed. This has been found to be effective at Ottawa, and will answer for places with a similar climate. Where there is not such intense cold, it is necessary to subject the combs to sulphur fumes. This will also answer, but is more troublesome. The Apiary at the Experimental Farm, managed by Mr. John Fixter, is a constant source of interest to visitors.

THE PEAR-TREE FLEA-LOUSE.

The Pear-tree Flea-louse, an insect which has not been noticed very much, but which does a considerable amount of harm in the Niagara district, is a small insect closely allied with the plant-lice or aphides. These pass the winter upon the bark of trees, in the crevices of the bark. A simple remedy has been found which gives good results, simply spraying the trees with lime wash. The exact effect of this I do not quite understand; it may be simply a mechanical effect of the spraying, by which the torpid insects are literally mortared up in the crevices of the bark and cannot emerge. So far, trees sprayed with lime experimentally have been found to be very free from this insect. The more troublesome spraying of trees with whale-oil soap or a mixture of whale-oil soap and crude petroleum is also very effective, destroying them by coming in contact with their bodies and suffocating them.

These are all the insects that I wish to bring before the attention of the Committee now, but there are just two other subjects that in the time at my disposal I would like to refer to.

THE CURRANT WORM.

By Mr. Erb:

Q. Before you leave the subject of insects, would you state the best and most effective remedy for killing off the worms on gooseberry and currant bushes?

A. These are the caterpillars of a saw-fly, an insect belonging to the same natural order as bees and wasps, and, although the caterpillars look very much like those of moths, they differ in that they have many more legs than the true caterpillars of moths.

The best remedy is, I think, undoubtedly, a weak mixture of Paris green and water for the beginning of the season, and later White Hellebore, either dry or mixed with water.

The Currant Worms appear just at the time the bushes are coming into flower, and at that time the Paris green may be used. Later on, if neglected, as is usually the case, until the berries are partly grown, White Hellebore is a very effective remedy, and is quite safe to apply to growing fruit, whereas it is not safe to apply Paris green to gooseberries and currants when the berries have grown to a considerable size, for the reason that these fruits are used very often for cooking long before they are fully formed, or ripe, and the poisonous and non-soluble Paris green mixture, is therefore not safe; but at all times white hellebore is quite safe, and is specially fatal to all kinds of saw-fly larvae.

By Mr. Robinson (Elgin):

Q. How do you apply it?

A. With water or as a dry powder.

Q. The same as arsenic?

A. Well, as arsenical poisons. I never advise the use of white arsenic. The usual mixture is of 2 ounces to 2½ gallons of water, or in a dry mixture, one pound of hellebore mixed with four times its weight of flour.

THE TURNIP APHIS.

By Mr. Blain:

Q. What is the best remedy for the fly that appears on the turnip crop?

A. The Turnip Aphis or plant-louse. This insect was abundant last year in New Brunswick and Nova Scotia. Most other parts of Canada were rather freer from it than usual. The habits of this insect must be considered, in using a remedy, and we find that it appears on the fields just about the time the turnips are thinned out, and also a characteristic of the attack is that it begins in small patches from which it gradually spreads and covers the whole field. We found it could be controlled in either of two ways, either by the men looking for the first colonies when hoeing, and when they see the clusters, which are very easily distinguished, hoeing out the infested turnips and destroying them by treading under foot, or if they have got beyond that, spraying the patches with coal oil emulsion or whale-oil soap solution, applied with a knapsack sprayer. Whale-oil soap, 1 pound to 6 gallons of water, or the ordinary kerosene emulsion, which is used for many kinds of sucking insects; either of these remedies is very effective and destroys the insects before they spread over the field.

NOXIOUS WEEDS.

There are a few weeds that have given a good deal of trouble in Canada largely I think, through their nature not being considered when farmers try to control them. Probably it is impossible to decide what plant should be stigmatised as the worst weed in Canada to-day, because what is the worst weed is generally a moot question in different places, and with different people. I have made a list of twenty-eight distinct plants which at different times I have had sent or shown to me as the 'worst weed,' and I find the 'worst' is usually the one that gives the farmer who is speaking, the most trouble on his own farm.

I think the weed giving more trouble than any other over a wide area in Canada to-day is the

PERENNIAL SOW-THISTLE.

a plant which is called a thistle because its leaves are rather prickly. It grows about three feet high. The young plant starts from the seed as all plants do, of course, and the first year it makes a rosette of leaves on the ground, a single rosette. The next year several shoots appear around that, and one strong stem is thrown up. This strong stem bears four or five large yellow flowers, by which it can be readily recognized; these are like dandelion flowers, which blossom just as the small grains are coming into head. While the grain is growing, the flowers stand up four or five inches above the grain. The plant has an underground root system which extends very far from the central point, and at the top of each underground branch is developed a large cluster of leaves as big as a breakfast plate. The leaves lie flat, and no grain can grow where they are. It spreads very rapidly and is a deep-rooted perennial. When once established in land, it requires a deal of attention, and hard persistent work to eradicate it. It is a very bad weed, and must be treated specially if a farmer wishes to clear up his land. The best treatment is to plough the land deeply in hot weather, and then cultivate it once after that, and, if possible, put in a late crop, to be cut green for feed, or a summer smother crop such as rape, Hungarian millet, clover or buckwheat, which can either be used afterwards for seed or as green feed, and then ploughed down. This will so much weaken the sow-thistle, that in the next year a hoed crop will clear it out, if well cultivated. The point about this weed is that it is deep-rooted, and for that reason an important part of the treatment must be deep-ploughing and the breaking up of the underground stems, so as to induce them to make a second growth, and then disturbing them so that new plants cannot get established, but the stored food in the root-stocks is exhausted.

Q. It grows from the seed ?

A. Very largely and also from the root. The seed bears a silky or downy wing or pappus, by which it is blown long distances over the country. In some parishes around Quebec, it has become very troublesome, and it is a great nuisance to threshers. When threshing grain, the silky covering breaks up and gets into the eyes of the threshers, causing so much trouble that they are compelled to use veils to protect their eyes.

Another weed, of a slightly different nature, which is well known by all farmers, is

QUACK GRASS.

The very name Quack Grass to most farmers suggests the worst weed that can be found ; but, as a matter of fact, after we examine into the true nature of Quack Grass, it is not nearly so hard to get out of land as many others.

By Mr. Ross (Ontario):

Q. Is that Twitch Grass ?

A. Yes ; it is called Twitch, Scotch. Quack, Couch, and almost any other conceivable change that can be made in the sound of the name. A knowledge of the true nature of this plant is the secret of destroying it, and that is that it does not root deeply, only about four inches deep. Therefore the remedy is not to plough deeply as is often done. It roots near the surface, so, if by shallow ploughing, the plants is thrown up on the surface in hot weather, it will dry out. In about a week it may be harrowed, and a great quantity of the grass will be drawn off in the harrows ; what remains is much weakened, and, if disturbed at intervals of about ten days, as with a disk harrow, it soon becomes manageable. By deep ploughing the plants are merely turned over in the soil and replanted, so that more harm is done than good.

SWEET GRASS.

In the North-west and Manitoba there is another grass which is wrongly called by the same name, and this mistake has been very disastrous to farmers, because they have applied the wrong treatment. This grass is called Sweet Grass, and is of an entirely different character from Quack Grass, in that it roots very deeply indeed, and to plough it shallow, simply improves it and increases its vigour so that it grows more freely and does more harm than it did before. The general rule for deep-rooted perennials is to plough as deeply as possible, so as to get out as much of the plant and root-system as possible, and for shallow-rooted perennials to plough just as close to the surface as possible, so as to throw them up on the surface and let them dry out. In the Edmonton district last summer I found that Sweet Grass had increased enormously, and when I came to inquire into it, I found that they had many of them received the experimental farm or the North-west Government bulletins on weeds, where they read that the remedy given for Quack Grass was to plough as shallow as possible. Now the farmers are very wide awake up there in that new district, and have followed faithfully, good advice given to them by specialists. In this case, unfortunately, having given the wrong name to the grass they were troubled with, they applied the wrong remedy, which unluckily was the direct opposite to what should have been done, and Sweet Grass has increased to an alarming extent.

By Mr. Robinson (Elgin):

Q. Are they similar in appearance?

A. Not in the least. Sweet Grass is a bright green grass, which flowers very early does not flower until July. The flowers too are quite different. The same treatment being given to both, it destroyed the Quack Grass so that it was not seen at all on many farms, but the Sweet Grass had increased enormously. I had several opportunities of pointing out the difference at the North-west summer weed meetings.

By Mr. Erb:

Q. Have you been able to exterminate the Quack Grass from the central experimental farm here?

A. I have a patch in the experimental grass beds which I may say rather hurts the feelings of some of our farmer friends who come to the Farm, and see this patch, in the experimental grass plots. They do not believe in it, and do not want anything of that kind. But that patch has been kept there for a special purpose. It has been there now, for eleven years, and it has not spread at all from the patch itself, showing that, where it is treated properly, it can be managed. We have had no trouble in eradicating it in other plots where it has sprung up; but there is a great deal of it through the country, and it is frequently re-introduced on farms which have been cleared. Such patches as spring up on the central farm, we have no trouble in destroying, in the way I have mentioned. When we began work, some of the fields were simply beds of Quack Grass.

By Mr. Robinson (Elgin):

Q. Do you keep the Quack Grass there as an object lesson?

A. Yes; in that particular plot.

By Mr. Erb:

Q. In the field corn crop last year, was not that field full of Quack Grass when it was ploughed?

A. The field over beyond the barns?

Q. Over on the other side. I was there when it was ploughed, and I am greatly mistaken if it was not Quack Grass I saw there, 6 inches high.

A. Do you mean in among the corn?

Q. Yes.

A. That may have been the reason the corn was put there, as a clearing crop. I fancy it was cleaned out pretty well afterwards. I do not remember the particular field you mention, however.

Q. It was where the main corn crop was.

A. Yes; the fields in the front of the farm, in front of where the original cottages stood, were full of Quack Grass, when we took over the land.

Q. Yes; I saw them.

A. These are all pretty well cleaned now, but they were very bad, indeed.

By Mr. Stephens:

Q. Have you had any complaint about the Sweet Williams growing along the road and getting into the fields?

A. The garden Sweet William?

Q. Yes. Along the roads in the county of Kent, on each side of the roadway, they are thick with it, and in some places it has gone through the fence and extended ten or twelve rods into the field.

A. I wonder if that is not a name given locally, to some plant with another name.

Q. They call it Sweet William; it is a tall weed, and grows very thickly, and always grows very heavily upon a clay soil, but never occurs to any extent on a light soil?

A. I fancy that must be a local name for it. If you will send me a specimen, I would like to get it, so that I may determine what it is.

By Mr. Erb:

Q. Has it a leaf like clover? It might be the wild sweet clover?

A. I think not. That is not a troublesome weed on farms, because it is a biennial plant, which only lives two years, and, if it is ploughed up the first year, or cut the second year regularly, it cannot form seed, and it will die out.

BOKHARA CLOVER.

By Mr. Robinson (Elgin):

Q. It is sweet clover you are speaking about now?

A. Yes.

Q. I notice it is growing very much in the cities and towns?

A. Yes, but it is not a plant that is very troublesome, nor is it of much use for agricultural purposes. The seed is sold under the name of Bokhara clover; but it is not very good for stock; they will only take a little of it, and, when it is turned into hay, they do not care much for it. When treated as a crop, it will grow to a height of four or five feet before it gets too tough to cut, but it has never been found very useful as a fodder plant. It is most highly valued by bee-keepers, who find it a good honey plant.

BALL MUSTARD.

A weed which has been bad all over the Edmonton district and has spread very largely there during the past four or five years, is known by the name of the Ball Mustard. It is a European weed which was only introduced into Canada ten or fifteen years ago, but it is now a conspicuous weed all through the Edmonton district. I think the spread of this weed has been entirely due to lack of care in cleaning the seed. It is, as everyone knows, a very important matter to have seed properly cleaned; but it has not been considered of sufficient importance, in the North-west at any rate, for farmers to give the amount of care which should be given to cleaning seed, if they

wish to keep weeds out of new districts. This precaution would afterwards save them a great deal of trouble on their farms. Like that of the ordinary mustard, the flower is yellow, but it is more of an orange yellow, and is very conspicuous in the fields, over large areas in the West, from Manitoba to the Rocky Mountains. It does not occur as a farm weed in any other part of Canada. The fallacy that is very prevalent with regard to the ordinary mustard in this part of the country, exists with this plant also, that because after a time it cannot be seen, therefore no harm comes from it. But this of course, is ridiculous; the reason that it is not seen, is not because it is not there, but because it is covered up by the growing crop. It was very injurious when it was growing, as it robbed the soil of the plant food which the crop required, and it also crowded out the other plants. Every sensible person recognizes that Wild Mustard is a bad weed, and indeed it is so bad that it will take a generation to clean thoroughly, badly infested land. This is not such a bad weed, probably, as the ordinary eastern Wild Mustard. The Ball Mustard can be prevented from spreading to a large extent by cleaning the seed a little more thoroughly than has been done in the past. I feel sure that the chief reason this weed has spread so much in the West is that seed grain has not been well enough cleaned. This seed is not easy to notice when it is among the wheat. The seed pod is very small and roundish in shape; there is only one seed in a pod, and when the pod ripens and dries up, it is much wrinkled on the outside, so that it looks like a little piece of brown mud which is not particularly noticeable among the grain. For that reason, I think, it has been overlooked, and has consequently spread very rapidly. Its spread, however, can be prevented by merely following the ordinary methods of good clean farming.

By Mr. McEwen:

Q. Can the seed be taken out with the ordinary seed cleaner?

A. It can be screened out easily, as it is much smaller than wheat, and, where an extra winnowing is given, the seed grain is cleaned thoroughly and good clean crops of grain are the result. When this weed is in the land, it increases and gives much trouble, and it must be recognized as an enemy, worth attending to. In the West, where they regularly summer fallow every second year, the land is, of course, very much more easily cleaned of such weeds as this, than it is in the East, where we use the land continuously year after year.

Q. You have no idea how long it will remain in the ground?

A. It is only an annual, and comes from seed every year. I do not know how long the seed will remain in the soil, but I do not think it will lie in the ground for the same time as the ordinary mustard, because, on some farms which have been carefully worked, it has been exterminated, while the ordinary Wild Mustard will come up year after year, even although the ground be cleared of every plant which shows itself.

SPRAYING TO DESTROY WILD MUSTARD.

A good remedy for Wild Mustard is to spray infested fields with a two per cent solution of copper sulphate just when the blossoms appear. In a paper published by Mr. Shutt, our Chemist, in my annual report of 1899, this whole matter was gone into thoroughly and details were given showing the excellent results which have been obtained in some places by spraying. In the West, however, where the farms are so much larger, the cost, which comes to about \$1 per acre, makes this remedy prohibitory, because where a farmer has 400 or 500 acres, he is not going to spend \$400 or \$500 to clean his wheat fields of mustard, when he has never had to do anything before, especially by a method he is unfamiliar with and which is not customary among his neighbours.

By Mr. Robinson (Elgin):

Q. Has this experiment been successful for mustard.

A. It has been very successful, indeed, and on smaller farms in the East and in restricted areas, answers perfectly, killing every plant of mustard above ground.

By Mr. McEwen:

Q. Is the spraying done after the crop is up?

A. Yes; after the crop is up. This remedy owes its efficacy to the action of the chemical on the leaves of the plant.

By Mr. Robinson (Elgin):

Q. It is when the mustard is in flower?

A. When the mustard is in flower, is the best time, but it will answer at any time after the seed has germinated.

By Mr. McEwen:

Q. It will kill the weed, but not the wheat?

A. No, it will not kill wheat at that strength. Mr. Shutt, our Chemist, finds that a 2 per cent solution is the best strength, that is 10 pounds of copper sulphate in 50 gallons of water, which is sprayed straight on to the crop. This will cover an acre of crop, will kill the mustard and will do no injury to wheat, grass or other grain.

STINK WEED

is a very bad weed in the West. It has an incredible power of increasing in Manitoba. Stink Weed will increase so rapidly and produce so many seeds that if introduced on to a farm, it becomes in a very short time a most serious pest. This weed is found all through Canada, but in no place is it as bad as in Manitoba. The best remedy is to run harrows, or weeders, through the growing grain, as soon as it appears above the ground. Wherever this plan has been adopted, it has been found very effective. It is not much practised with us in Canada, as yet, but it is well known in the Old Country, and harrowing the crop after it appears above ground is most beneficial by destroying hosts of weed seedlings on the surface. It is very good for the crop also, which is benefited by it in the same way that Indian corn is by being cultivated. If the harrow is too heavy, a few plants of the grain may be dragged out, but I would far rather harrow with too heavy a harrow than not harrow at all. I am certain that this use of harrows and weeders on growing grain is going to be one of the greatest factors in cleaning land of weeds in the West.

By Mr. Robinson (Elgin):

Q. What is the appearance of Stink Weed?

A. The most conspicuous characteristic is its dark green colour, darker than any other plant.

Q. With a stalk?

A. Yes, and with a bunch of small white flowers at the top, followed by large flat pods about the size of a five cent piece. These are produced in very large numbers, and the seeds remain in the land a long time.

Q. I never noticed any?

A. It is not abundant in Ontario, but in Manitoba it seems to have found conditions and soil peculiarly well suited to it, and it has become a veritable curse.

PEPPER GRASS

is another weed of the West, which in wet seasons, but on light land, gives much trouble by crowding out crops. It is not treated regularly by farmers, because it is only in occasional years that it increases to such an extent as to harm the crops. It is not a difficult plant to clear from land if attended to. It is a two-year plant, the seed of which germinates in the first year, and in the autumn appears on the ground as a small rosette of leaves. Early in the second year the stem is thrown out from the centre of this rosette of leaves, and the plants sometimes develop to large size, many being 2 feet high by as many wide and shaped like a little tree. Pepper grass grows out the crop by its thick mat-like growth. The remedy is to plough lightly or disc-harrow land for crop in autumn or spring. The plant has a central root which goes down a short distance into the soil, and this can be cut out by a cultivator or disc-harrow.

Q. Is that commonly known as smart weed ?

A. No, that is a different plant ; this belongs to the cross family, and is indeed a close relative of the garden cress.

THE ORANGE HAWKWEED.

By Mr. Brown:

Q. Do you know Paint-brush, a weed almost like the pink, and very abundant in broken-up land. It comes from the otherside, and has been introduced in our district ?

A. Is that in the Eastern Townships ?

Q. What you might call the townships, the counties of Chateauguy and Huntingdon ?

A. Yes ; it is one of the Hawkweeds, the Orange Hawkweed, and was undoubtedly introduced from Vermont, the seed being blown over to us. It has also been grown in gardens for its showy deep orange flowers ; but it is a weed which gives much trouble in rocky land, and soon destroys upland pastures. It has been found that broadcasting a ton and a-half of salt over the land will kill it. If you go beyond a ton and a-half or two tons, it will injure the grass, but the smaller amount actually stimulates growth.

PIGEON WEED,—ALIAS, RED-ROOT.

By Mr. Stephens:

Q. Have you explained to the committee the way to get rid of Red-root ?

A. No ; is that in western Ontario ?

Q. Yes.

A. And growing among fall wheat ?

Q. In fall wheat mostly ; it scarcely ever grows in spring crops ?

A. That is because, like fall wheat, it is a two-year plant. There is not much of that weed in this part of Canada.

Q. Some farms in Kent have been almost ruined ; the richer the land, the worse it grows ?

A. The best way to clear land of this weed is to give up the cultivation of fall wheat on infested fields and sow spring crops, and where the weed is abundant, the land must be cultivated in the fall or in the spring.

By Mr. Robinson (Elgin):

Q. Is that what is commonly called Pigeon Weed ?

A. Yes ; and it is a better name for the plant, to which the name Red-root is most commonly applied, is Pigweed. The English name is Corn-field Gromwell, but

that name is not applicable in Canada, because wheat is not called corn here. In England wheat is called corn, so the name of the weed is not appropriate, but here, as we do not use the word 'corn' in the same sense, 'Corn-field Gromwell' would give a wrong impression. Maize is what we commonly call corn in Canada. Pigeon Weed is, perhaps, the best name, as it is not used for any other plant. Red-root is a very good name, and explains itself, because the root is pinkish. I think the easiest remedy is to give up fall wheat and sow spring crops for a time.

By Mr. Stephens:

Q. How long will the seed lie in the ground ; is there much oil in it ?

A. I do not know ; I do not think it is one of those seeds which has much oil in it. It is the oil in Wild Mustard seed which allows it to lie so long as it does in the soil without decaying. These seeds are protected by a rough hard coat, from which they take their scientific name *Lithospermum*, or stone-seed.

By Mr. Robinson (Elgin):

Q. You have not much of it here ?

A. No ; we have not any here, but I have often had it sent down from the West for information as to the best way of treating it.

FIELD BINDWEED.

By Mr. McEwen:

Q. I suppose you never come into contact with Bindweed ?

A. Oh, yes, I am sorry to say I do, but it is not very abundant at Ottawa.

Q. What is your opinion of it ?

A. I have never been able to do very much with it, excepting by attacking it all the time, breaking up the root stocks and never allowing a shoot to appear above the ground.

By Mr. Robinson (Elgin):

Q. Give me a remedy for that, and I think I could give you a good present.

A. It is a weed which is bad in some parts of Ontario, but we have very little at the Farm yet, except a patch in the orchard and a little in the arboretum in the perennial flower border, where it was probably introduced with some other plant. We have done nothing satisfactory with it as yet. Mr. Macoun apparently killed a patch in the orchard by covering it up with salt. It is a very persistent weed indeed.

Q. I have it in my garden !

A. It has a deep fleshy root stock, which holds much nourishment ; so it is very hard to get rid of.

By Mr. McEwen:

Q. You have found no way to get rid of it ?

A. No practical way as yet. It is not so widespread as some other weeds, but is decidedly more abundant than it was some years ago. Twenty years ago it was hard to find, and botanists were glad to get specimens of it to add to their collections. Now, it can be found in many localities.

By Mr. Robinson (Elgin):

Q. Is Bindweed the proper name for it ?

A. Yes ; Field Bindweed.

Q. It has a white flower ?

A. Yes ; a white convolvulus-shaped flower. It is a perennial, and roots very deeply. It is a true *Convolvulus*.

By Mr. McEwen:

Q. You have no special way of treating it, then ?

A. No ; none so far, but we are experimenting with it at the central farm. There is the patch in the arboretum, and the one in the orchard, which Mr. Macoun is experimenting with. He covered it up deeply with salt, but the quantity required made the remedy more expensive than anyone could apply on a large area, and also rendered the land useless for a time.

Q. If you were to put enough salt on the ground to cover the weed, would it kill it ?

A. I think so.

Q. Would it not come up somewhere else outside ?

A. If the root stocks had run out beyond the patch ; but you could extend the salt.

Q. And keep extending the salt ?

A. Yes ; but no further growth of root stocks could be made, unless there were leaves. Any plant which is prevented from forming leaves, must die of starvation. The idea of using salt is to destroy the whole of the leaf surface until the root system is so exhausted that it cannot throw out any more shoots.

By Mr. McEwen:

Q. But apparently the roots will creep to some extent before you have salted everywhere. After you have salted in every place you have seen it, it will come out some place else ?

A. Well, no ; the roots cannot keep growing unless they have been filled with strength from the leaves. What are usually called roots of this plant are underground stems, and these are only so persistent because they are filled with a large supply of nourishment, which is taken in by the leaves, and, unless there are healthy leaves on the plant, it cannot form root stocks.

Q. But suppose a field of say ten acres, it would be almost utterly impossible to salt it, in order to kill off these weeds. Unless there is some other way, it would not be practicable, but of course on a small patch—

A. Quite so. That is why I said I had no practical remedy yet.

Q. A man who had his place covered with it, would have to have some other way of dealing with it, or it would not be practicable ?

A. Quite so. Like many introduced plants, it causes no trouble in England. It grows in every part of the south of England, and never causes any trouble.

Q. I understand it was imported here for grass purposes in the first place ?

A. It may have been, but I had not heard of that before ; it would not make a very good crop.

Q. You get plenty of it ?

A. Well, hardly, if you were growing it as a crop.

LAWN GRASSES AND MANURES.

By Mr. Ross (Ontario):

Q. How would you renew a lawn that had been planted for say ten years and had got tired, as it were, and was not doing very well, without breaking it up.

A. The soil conditions would probably be the chief trouble, because the land should not become exhausted for a lawn, unless there was some reason for it in the way of soil or drainage. Grass on lawns will sometimes get thin if the soil is too wet or it is too much shaded, and moss will come in it. But on land that seems as if the conditions were satisfactory, raking heavily in the spring and sowing a little Kentucky blue grass and white clover would be the best way to renew it. A little white clover is a good addition, unless it is preferred to have all grass. It forms a thick heavy

bottom and binds the lawn. One trouble in seeding lawns is that people who want a lawn, go to the seedsman and ask for a grass lawn mixture. This is a great mistake. You want only one grass, Kentucky Blue Grass, or June Grass, as we call it in Canada. This is the very best grass for a lawn in any part of the world, where lawns succeed. It is exactly the same grass which is called in England, Smooth Meadow-grass, the best lawn grass there, and also one of the wild grasses of Canada. It should be sown at the rate of two bushels to the acre, which is a thick sowing, so as to form very thin delicate leaves, delicate in the sense of fineness, growing so close together that they form a close sod. A little white clover with this grass gives a thick bottom which prevents drying out in hot weather.

Q. Is it all right to sow now ?

A. This is the best time. Rake the old sod heavily, sow the seed and then roll it.

Q. What about the manures for lawns ?

A. The best and safest are the chemical fertilizers ; even old rotted manure may have weed seeds in it.

Q. Barnyard manure contains seeds ?

A. Very often. If thoroughly turned over and rotted well, then it could be used in the autumn and in spring ; instead of having it all raked off, rake lightly and break up thoroughly what is left and work in to the roots.

Q. Is wood ashes a good thing for lawns ?

A. Excellent on most lands.

Q. But you can put on too much of it ?

A. Yes.

By Mr. Blain:

Q. What about dandelions that grow up in the lawn ?

A. They are rather difficult to get rid of. They are a deep-rooted perennial, and I am afraid there is no other remedy except digging them out.

By Mr. Stephens:

Q. Cutting them off in spring, is that good ?

A. Not very ; they are pretty sure to throw up shoots later.

Q. Cutting them off underground ?

A. You have to cut down very deeply. The root of the dandelion, although really a true root, will throw out leaf shoots when cut off below the collar. If a dandelion root of a foot deep is cut into pieces, these will throw out leaves at each end. I tried an experiment in a hot-bed, to prove this, some years ago, and, having dug up a root a foot long and cut it into six pieces, which I put in the soil of a hot-bed, they threw out leaf shoots from either end of the separate pieces. It is an exceedingly persistent plant, and I am afraid the only remedy is to dig them out persistently with chisels, which may be fastened in the end of a handle so as to avoid stooping.

By Mr. Blain:

Q. It spreads rapidly ?

A. That is from seeds, which are easily blown long distances.

By Mr. Robinson (Elgin):

Q. It spreads no other way except from seeds ?

A. No, because it has a single central root, and does not send out running shoots.

By Mr. Ross (Ontario):

Q. Did you ever try acids with them ?

A. Yes ; but that is hardly a practical remedy.

Q. I was in a beautiful lawn in England and asked why there were no dandelions, and I was told they used an acid, although I forget the name of the acid.

A. Sulphuric acid or arsenite of soda and salt are generally used, but of course these are more expensive, and more troublesome, than spudding out.

Q. It was done with a sharpened stick loaded with the acid; they put it right down in the centre of the plant.

A. Yes, I know the plan; but it is more expensive, and not more effective, I think, than digging out.

Q. This was a very handsome lawn?

A. Quite so; a great deal of trouble is taken with lawns in England.

By Mr. Robinson (Elgin):

Q. Dandelions do not injure the fields at all?

A. They are only troublesome weeds on lawns.

By Mr. Ross (Ontario):

Q. Would it be a good thing to draw a nice loam on to the land in the autumn and rake it in?

A. Yes; that is very frequently done in levelling up lawns and cricket fields: light loam is sifted evenly over hollows, and then worked in with a rake, using the back of the rake to level with.

AWNLESS BROME GRASS.

I will merely refer to Awnless Brome Grass briefly before closing, to say it is still giving excellent results and great satisfaction, in all parts of Canada, where it has been tried. In my outcoming report for 1901, I am printing a letter from Mr. Pater-son, the Deputy Minister of Agriculture for the North-west Territories, in which he gives the results of an experiment in which he sowed this grass on a raised knoll in a farm, the greater part of which he was irrigating. He used Brome Grass upon this knoll of nearly eight acres, because he could not get water up there, and its great value as a dry land grass was shown plainly. His net profit on the eight acres was \$413, which shows it is a very good grass for farmers in the west, to grow as a crop. He cut for seed, and sold the straw from which he had threshed the seed, as hay, at the low price of \$3 a ton, very much below its value, because it has a very high value as hay, even though the grass seed has been threshed from it. Awnless Brome Grass is different from most other grasses, because at the time the seed ripens, in addition to the central stem, which bears the seed, there are thrown up several other shoots from the base, so that the straw is not merely exhausted stems which have ripened seed, but has five or six vigorous young shoots in it in good condition, as well as the one stem which is bearing the seed; and besides there is a good deal of seed left in the straw which gives it added value as feed. The cultivation of this grass in the West, as a seed crop, is a very paying business. 400 or 500 pounds of seed can be reaped from an acre, which never sells at less than ten cents, and frequently 10, 12 or 13 cents a pound. The hay is excellent for stock, and as I have explained, even the straw from which the seed has been threshed. The value of this grass for growing, on alkaline lands, has been found to be great. Land too alkaline for other grasses, will support the brome and do better than any other grass tried on such land.

By Mr. McEwen:

Q. Is there any of it grown in this part of the country, at all?

A. Yes. It is now being grown to some extent in all parts of Canada.

Q. Have you it on the farm here?

A. Yes; and I can send you samples of the seed, if you would like to try them.

Q. Is it to be preferred to Timothy, in this part of the country?

A. No; for the reason that Timothy is well known, and has both an actual and an artificial value in the market. It is a well known hay, is always in demand, makes an excellent quality of hay, which is easily handled and easily pressed. The seed is always obtainable, and always in demand, is easily threshed and easily cleaned.

RECIPES FOR PREPARING INSECTICIDES AND FUNGICIDES.

I have here, Mr. Chairman, a few formulæ for insecticides and fungicides which, with the permission of the Committee, I would like to have put into my evidence, because I believe they will be useful to the Members.

KEROSENE EMULSION.

Kerosene emulsion, which is used for Lark-lice and other insects which suck the sap of plants, is made of two gallons of kerosene (coal oil), 1 gallon of rain water, and $\frac{1}{4}$ lb. soap. Dissolve the soap and water by boiling; take from the fire, and while hot, turn in the kerosene, and churn briskly for five minutes. To be diluted before use with 9 parts of water.

WHALE-OIL SOAP.

For scale insects (young) 1 lb. in 5 gallons of water.
For Turnip Aphis, aphis or thrip, 1 lb. in 6 gallons of water.
For San José Scale (in winter) $2\frac{1}{4}$ lbs. in 1 gallon of water.

TOBACCO AND SOAP WASH.

Soak in hot water for a few hours, 10 lbs. of tobacco leaves (home grown will do); strain off and add 2 lbs. of whale-oil soap. Stir until all is dissolved, and dilute to 40 gallons. Apply early and 2 or 3 times at short intervals.

LIME WASH.

Unslaked lime, 1 to 2 lbs.
Water, 1 gallon.
Strain through a sack before spraying. For use against Oyster-shell Bark-louse and Pear Paylla, or Flea-louse.

ALKALINE WASH.

The alkaline wash for Borers is made with soft soap or whale-oil soap, reduced to the consistency of thick paint, by the addition of a strong solution of washing soda in water. If applied with a brush about June 1, on the morning of a warm day, this will dry in a few hours and form a tenacious coating not easily dissolved by rain. If 1 pint of crude carbolic acid be added to the gallon of wash, it will make it more effective.

HELLEBORE.

White Hellebore, 1 oz.
Water, 2 gallons.
Or to be dusted undiluted over attacked plants.
Specially useful against Saw-fly larvæ.

PARIS GREEN.

To make the Paris green application to kill off insects which eat the foliage, the formula is:—

Paris green, 1 lb.
Unslaked lime, 1 lb.
Water, 160 gallons.

The dry mixture is made by mixing 1 lb. of Paris green with 50 lbs. of flour, land plaster, slaked lime or any other perfectly dry powder.

CANKERWORM WASH.

To destroy the Cankerworm spray early with the above Paris green wash.

To catch the female moths at the time the moths emerge, place around the trees paper bands, painted with an adhesive mixture, made as follows :—

For warm weather, castor oil, 2 lbs ; resin, 4 lbs ; and for cold weather, 2 lbs. of castor oil to 3 lbs of resin.

POISONED BORDEAUX MIXTURE.

The following is the formula for poisoned Bordeaux mixture for fungi on fruit trees :—

Copper sulphate (bluestone), 4 lbs.
Unslaked lime, 4 lbs.
Paris green (for leaf eating insects), 4 oz.
Water (1 bbl.), 40 gallons.

Dissolve the copper sulphate by suspending it in a wooden or earthen vessel containing 4 or 5 or more gallons of water. Slake the lime in another vessel. If the lime, when slaked, is lumpy or granular, it should be strained through coarse sacking or a fine sieve. Pour the copper sulphate solution into a barrel, or it may be dissolved in this in the first place ; half fill the barrel with water, add the slaked lime, gradually stirring all the time, and then fill the barrel with water and stir thoroughly. It is then ready for use. A stock solution of copper sulphate and a lime wash may be prepared and kept in separate covered barrels throughout the spraying season. The quantities of copper sulphate, lime and water should be carefully noted.

For Potato Rot use 6 lbs. of copper sulphate instead of 4 lbs., and spray directly on the foliage of the plants on August 1 and 15, and on September 1.

COPPER SULPHATE SOLUTION.

Copper sulphate (bluestone), 1 lb.
Water, 25 gallons.

As soon as dissolved, it is ready for use. For use on fruit trees and grape vines before the buds open only.

AMMONIACAL COPPER CARBONATE.

Copper carbonate, 5 oz.
Ammonia, 3 quarts.
Water (1 bbl.), 40 gallons.

Dissolve the copper carbonate in the ammonia. The ammonia and concentrated solution should be kept in glass or stone jars, tightly corked. It is ready for use as soon as diluted with the 40 gallons of water. To be used when Bordeaux mixture cannot be applied on account of staining the fruit.

Having read over the preceding transcript of my evidence, I find it correct.

JAMES FLETCHER,
Entomologist and Botanist to the Dominion Experimental Farms.



